AUTOMOBILE

Vol. XXXV
No. 16

NEW YORK, OCTOBER 19, 1916

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Chicago, Ill., U. S. A.

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, OCTOBER 19, 1916—CHICAGO No. 16

Brown-Lipe-Chapin Co. Sold

United Motors Buys Biggest Maker of Differential Gears in America

NEW YORK CITY, Oct. 16.—The Brown-Lipe-Chapin Co., Syracuse, N. Y., largest manufacturer of differential gears in America, has been purchased by the United Motors Corp. and the same policy with regard to the Brown-Lipe-Chapin Co. will be followed as is used by the United Motors Corp. with the several other concerns it has purchased. President Alfred P. Sloane, Jr., of the United Motors Corp., is authority for the statement that the general policy of Brown-Lipe-Chapin will be continued as at present but that the capacity of the plant in the manufacture of differentials will be doubled as soon as additional buildings can be erected. The large resources of the United Motors Corp. will give a broader foundation and scope to the Brown-Lipe-Chapin Co., and it is hoped to be able to manufacture differentials for all concerns needing them. President Sloane's name will be added to the board of directors of Brown-Lipe-Chapin, but H. W. Chapin will continue as general manager as he has in the past.

The purchase of the Brown-Lipe-Chapin Co. does not in any wise involve the Brown-Lipe Gear Co., of Syracuse, and which to date has been very closely connected with Brown-Lipe-Chapin. The Brown-Lipe Gear Co. is practically controlled by Messrs. Brown and Lipe, both

(*Continued on page* 650)

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Moore Heads Western Spring Sales

NEW YORK CITY, Oct. 14—Kirk Moore has been appointed general sales manager of the Western Spring & Axle Co. For some time Mr. Moore has been production manager of the Vim Motor Truck Co., Philadelphia, previous to which time he was sales manager for Weston-Mott and Northway motors. The Western Spring & Axle Co. comprises the Cleveland Axle Mfg. Co., Canton, Ohio; Cleveland-Canton Spring Co., Canton, Ohio; Hess-Pontiac Spring & Axle Co., Pontiac, Mich.; Hess Spring & Axle Co., Cincinnati, Ohio; J. B. Armstrong Mfg. Co., Flint, Mich.; Cincinnati & Hammond Spring Co., Cincinnati, Ohio; Amsted Spring & Axle Co., Connersville, Ind.; Spears Axle Co., Wheeling, W. Va.; Champ Spring Co., St. Louis, Mo.

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Coffin on Defence Commission

NEW YORK CITY, Oct. 12—President Wilson has named seven members of the Advisory Commission, associated with the Council of National Defense to study and suggest methods of increasing industrial and military efficiency of transportation and manufacture of munitions of war. The automobile industry is represented by Howard E. Coffin, other members being Daniel Willard, president of the B. & O., Samuel Gompers, President of the American Federation of Labor, Dr. Franklin H. Martin, Bernard Baruch, Dr. Hollis Godfrey and Julius Rosenwald.

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King to Raise Car Prices

DETROIT, MICH., Oct. 15—The King Motor Car Co. will soon increase the price of its cars to take effect in about 60 days. The firm states it will soon be impossible to manufacture an automobile of the quality of the King eight-cylinder type to retail at $1,350.

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Standard Parts Co. Merger Name

CLEVELAND, OHIO, Oct. 15—The corporation to be formed by the consolidation of the Perfection Spring Co. and Standard Welding Co. may be known as the Standard Parts Co. Seven per cent cumulative preferred stock may be offered at par or very close to that figure in the near future.

G. M. Corp. Capital $102,600,000

Readjustment Plan Approved —$82,600,000 Common and $20,000,000 Preferred

NEW YORK CITY, Oct. 16—The final organization of the new General Motors Corp. which has been effected under Delaware laws, reveals that the authorized capital stock will be $102,600,000. The formal approval of the readjustment plan which was first made public in THE AUTOMOBILE for Sept. 28 has been given by upward of 70 per cent of the holders of outstanding stock and has been forwarded to the shareholders of the General Motors Co. The plan has been signed by every member of the board of directors except J. A. Haskell, who is in Europe.

Readjustment Plan the Same

The readjustment plan is the same as was first made public. Of the total capitalization $82,600,000 is common stock and $20,000,000 is non-voting preferred stock, all shares having a par value of $100. The preferred stock is entitled to receive cumulative dividends at the rate of 6 per cent and is subject to redemption at the option of the company at $110 on Nov. 1, 1918, or any subsequent dividend date.

The distribution of stock in the Delaware corporation remains unchanged, shareholders of the General Motors Co. of New Jersey having the privilege of exchanging each share of preferred stock for one and one-third shares of new preferred stock, and one share of common stock for five shares of the new common stock. Deposits for exchange are to be made with the Guaranty Trust Co., New York, between Oct. 15 and Dec. 16 inclusive. The readjustment plan becomes effective Nov. 1.

Accessory Space Allotted

Stiger Succeeds Lovell as Assn. Pres. and Bradley Takes Sweet's Place

NEW YORK CITY, Oct. 14—Eighty-seven accessory concerns have been allotted space at the national shows in this city and Chicago. After adding sixteen concerns which will exhibit in this city only, the New York total thus far reaches 103. Twelve concerns will exhibit only in Chicago, thus making the total number to date there, ninety-nine. Last year New York was given eighty-seven and Chicago, eighty-three.

A meeting of the show and allotment committee of the Motor and Accessory Manufacturers was given yesterday at which space was given to 115 members, compared with ninety-five last year.

Several new companies will exhibit at these shows this year, including the following: A. B. C. Starter Co.; Au-To Compressor Co.; Detroit Weatherproof Body Co.; Evapco Mfg. Co.; Ferro Machine & Foundry Co.; Hall-Thompson Co.; Kokomo Electric Co.; Leather Tire

(*Continued on page* 681)

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Olympian Motors Co. Formed

PONTIAC, MICH., Oct. 17—The Olympian Motors Co., this city, has been organized to build an automobile selling at less than $1,000. R. A. Palmer, prominent in the business activities of the Cartercar company, will head the new company and he will have associated with him as executives G. C. Bull, treasurer; C. E. Callender, secretary; and A. M. Stryker, advertising manager.

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McClure Tire & Rubber Co. Formed

COLUMBUS, OHIO, Oct. 14—The McClure Tire & Rubber Co., which has been in business for about 3 years in East Gay Street, has been incorporated with J. A. McClure, Jr., president; E. Buchanan, vice-president, and Robert McClure, secretary and treasurer. A lease has been taken on a new building now in course of construction at 214-218 East Gay Street.

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Thompson Is Miller Advertising Director

AKRON, OHIO, Oct. 14—C. S. Thompson has been appointed advertising director of the Miller Rubber Co., this city. Mr. Thompson was formerly president of the Thompson-Carroll Co., Cleveland.

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Hutchinson Overland Branch Manager

TOLEDO, OHIO, Oct. 14—Guy Hutchinson has joined the Willys-Overland Co. to act as branch manager for Willys-Overland, Inc., New York City. Mr. Hutchinson was formerly sales manager and treasurer of the firm of Hart & Hutchinson.

G. M. Graham will assume the position of research and publicity manager for the advertising department of the Willys-Overland company on Nov. 1. Mr. Graham was formerly the sporting editor and automobile editor for the Philadelphia *North American*.

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Manhattan Electrical Supply Reorganized

NEW YORK CITY, Oct. 14—The Manhattan Electrical Supply Co., this city, maker of the Red Seal battery, which was recently reorganized with an issue of $1,500,000 first preferred, $500,000 second preferred and $3,000,000 common, reports that all of the 7 per cent first preferred stock issued has been purchased.

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Organize Truck Holding Co.

DETROIT, MICH., Oct. 13—Organization of a holding company in New York to be known as the United Truck and Equipment Co., with incorporation in Michigan, to operate the United Motor Truck Co., is being perfected. Other companies may be controlled by the holding company, possibly including the Republic Truck Co., Alma, Mich.

Capitalization of the new company will be more than $400,000, and it is understood that $60,000 or more will be stock without par value or practically common stock.

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New Auto Parts Corporation

DETROIT, MICH., Oct. 14—The Canton Auto Parts Mfg. Co., Canton, Ohio, has been organized and incorporated with a capital stock of $300,000 to manufacture all kinds of automobile parts. S. S. Kurtz who is vice-president of the McCaskey Register company of Alliance, Ohio, and J. M. Kurtz are the principal stockholders. The company will be ready for operation about Oct. 24.

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Eisenberg Is Scripps-Booth Engineer

DETROIT, MICH., Oct. 17—H. O. C. Eisenberg, formerly engineer of the S. G. V. Co., has been appointed chief engineer of the Scripps-Booth Corp., succeeding Charles A. Ericston, who has resigned.

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Kopf Opens Chicago Office

CHICAGO, ILL., Oct. 16—M. G. Kopf has opened an office at 620 Chemical Building, Chicago, and will specialize in chemical electrical lines as applied to automobile engineering and patent matters. Mr. Kopf was formerly chief engineer of the McCormick Laboratories, Dayton, Ohio.

Lenox Co. To Make Tractors

Two Models at $4,500 and $2,000 Respectively—Passenger Cars Continued

HYDE PARK, MASS., Oct. 9.—Two tractors, one selling for $4,500 and the other for $2,000 represent what the Lenox Motor Car Co., with a plant at Hyde Park, Mass., is now building. They are to be known as the Lenox-American tractors. They will not interfere with the building of automobiles. The tractors were designed by R. B. Morton, whose father built the first ones made by the International Harvester Co. Additional capital has been brought into the company, President Howard having resigned from a big shoe concern to take the presidency.

The Lenox-American large tractor weighs 12,500 lb. The two big features of these tractors are the four wheel drive and four wheel steer. Self starters are a third. There is a three-speed transmission, patented worm and sleeve clutch and the same lever that operates the clutch also operates the brake. Another good feature is the control lever that takes the place of the governor. This little lever drops into a notch and takes up the speed of the engine. The operator steers the axles, not the wheels. The big tractor was made to turn in a circle the inner diameter of which was less than its own length of 16 ft. The steering gear is not of the ordinary cast type, but is worm and gear run in oil. The drive chain performs like a belt.

Axles are semi-floating and packed in grease. The power is transmitted direct from the driving axles to the face of the four lightweight drive wheels by pull rods so that none of the driving strain comes on the spokes. The wheels of the big tractor are 60 in. high, with 18 in. face, and the smaller are 48 by 10 in.

Two levers control the tractor. One is used solely to shift gears. With the other first the clutch is released, then the throttle closes and last of all the brake is applied. On the reverse motion of this second lever the brake is released, engine speeded up and the clutch engaged.

The company plans to build about 300 of the tractors the first season.

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Wilson Takes Over Sales Duties

DETROIT, MICH., Oct. 17—George D. Wilson, production manager of the C. R. Wilson Body Co., has also assumed the duties of sales manager. Charles F. Barth has been appointed works manager of the company.

Crankshaft Corp. Issues Stock

2500 Shares 7 Per Cent Preferred and 7500 Shares of Common

DETROIT, MICH., Oct. 16—The Automobile Crank Shaft Corp., which recently absorbed the business of the Auto Crank Shaft Co., has authorized the issue of stock amounting to $250,000, which is divided into 2500 shares of 7 per cent cumulative preferred stock, par value $100, and 7500 shares of common stock of no par value.

According to a statement issued by James M. Hibbard, secretary and treasurer of the corporation, the company will manufacture 72,000 crankshafts this coming year, which is less than one-third of the business offered, the records showing that, because of limited capacity, the company was forced to refuse 153,000 shafts.

Provision is now being made to at least double the capacity of the plant by February, 1917. Present customers include over twenty-five of the most prominent concerns in the automobile industry among whom are Studebaker, Stutz, Stearns, Winton, Peerless, National, Mercer, Locomobile, Hupp and Cadillac.

The net earnings of the company are 300 per cent in excess of those of 1914 and equal to eight times the maximum amount of dividends upon the preferred stock. The directorate includes among its members: A. R. Demory, vice-president of the Timken-Detroit Axle Co., and Henry H. Sanger, vice-president of the Hayes Mfg. Co.

AUTOMOBILE CRANKSHAFT CORPORATION STATEMENT FOR 8 MONTHS ENDING AUG. 31, 1916:

Assets		
Land and buildings		$56,397.85
Equipment, tools, furniture, fixtures and machinery		186,672.63
Less reserve for depreciation	$2,938.58	
Work in process (labor and overhead expense)		16,845.20
Factory materials and supplies		6,748.37
Accounts receivable (customers)		70,719.27
Less reserve for doubtful accounts	16,323.40	
Insurance premiums unexpired		100.12
Prepaid taxes		1,444.96
Total assets		$342,878.79
Liabilities		
Preferred stock—7 per cent cumulative—2500 shares, par value $100		$250,000.00
Balance represented by 7500 shares of no par value common stock		65,565.41
Accounts payable—trade creditors		18,394.99
Bills payable		None
Accrued salaries and wages		7,431.74
Accrued liability insurance		486.41
Reserve for Federal income tax		1,000.00
Total liabilities		$342,878.79

Woodruff Is Simplex Sales Manager

NEW YORK CITY, Oct. 18—A. A. Woodruff has been appointed sales manager of the Simplex Automobile Co., succeeding R. M. Barbour, resigned. Mr. Woodruff joined this company this year as manager of the body department. Later he became assistant sales manager. He has been in the automobile field since 1900, when he formed the Woodruff Mfg. Co., to build automobile bodies, later becoming connected with the E. R. Thomas Motor Co., later becoming producing manager. In 1912 he became eastern sales manager American Motors Co. and the Lexington-Howard Co. as manager.

Henry Splitdorf Dead

NEW YORK CITY, Oct. 17—Henry Splitdorf, inventor of the magneto bearing his name, died in his home in this city yesterday at the age of eighty-two. His eldest son, C. F. Splitdorf, is head of the Splitdorf Electrical Co., Newark, N. J.

Mr. Splitdorf was a native of Germany. He was the pioneer of telegraph instrument makers, having made them for Professor Morse, the inventor of telegraphy. Mr. Splitdorf was the inventor of the liquid insulation of the magnetic wire.

Agnew Directs Chalmers Advertising

DETROIT, MICH., Oct. 17—W. L. Agnew, who resigned as advertising manager of the Hudson Motor Car Co. some few months ago, to accept the position of assistant manager of the sales promotion department of the Chalmers Motor Co., has been appointed advertising and publicity director of the Chalmers company.

Tisch to Make Dean Knife Timers

DETROIT, MICH., Oct. 13—The Tisch Auto Supply Co., Grand Rapids, has purchased the Dean Knife timer for Ford car rights and will manufacture them under the supervision of W. B. Dean.

Pa. S. A. E. Meets Oct. 26

PHILADELPHIA, PA., Oct. 14—The first meeting of the Pennsylvania Section of the Society of Automobile Engineers for the season of 1916-17 will be held at the Engineers' Club, 1317 Spruce Street, Philadelphia, on Thursday evening, Oct. 26. Herbert Chase, chief engineer, Automobile Club of America, will speak on "The Otto Cycle versus Constant Pressure Cycle For Automobile Engines."

This meeting will be the last of the current administration year and the annual election of officers will be held.

Doble Paper on Steam Automobile

CLEVELAND, OHIO, Oct. 13—Abner Doble, designer of a steam automobile bearing his name, will deliver a paper before the local section of the Society of Automobile Engineers on Oct. 20, covering his work on the steam car.

S. A. E. To Discuss Aluminum

Paper By J. E. Diamond Treats Exhaustively on Use for Automobiles

NEW YORK CITY, Oct. 18—A paper entitled, "Aluminum and Its Use in Modern Aeroplane Motor and Motor Car Construction," will be read by James E. Diamond before the Metropolitan section of the S. A. E. here to-morrow night at its opening session of the season. Mr. Diamond is consulting engineer, Aluminum Castings Co., Cleveland, Ohio.

The introduction to Mr. Diamond's paper touches upon the abundance of aluminum, pointing out that aluminum in nature is more abundant than any other metal and that it constitutes approximately 8 per cent of the earth's crust. The discovery of aluminum is touched upon, this happening shortly after the beginning of the nineteenth century. Mention is made of the progress made in the methods of reduction from time of Woehler to the year 1886, when electricity was first utilized in reducing the ores of aluminum.

The metallurgy involved in the reduction of aluminum by the process invented by Charles M. Hall is briefly sketched.

Some little space is devoted to a discussion of the physical properties of aluminum. The alloy field is covered briefly. The foundry likewise comes in for attention. The very great care necessary in the production of successful castings is touched on at some length. Such factors as furnace temperature, pouring temperatures are touched upon. A statement is made that there is probably no one factor of vital importance than the pouring temperature and "that casting which is barely escaped being a mis-run in the finished section due to a low pouring temperature is the best casting from all standpoints. Explanation for this is given. The need for supervision by technically trained men in every stage in the evolution of a casting is emphasized very strongly.

The employment of aluminum castings in motor car and also aero motor construction is considered. The employment of aluminum castings almost invariably for the larger units in the motor car is mentioned. These parts are, of course, the crank and transmission cases. The employment of the former in all cases where the cylinders and and crankcase are not cast integral is characterized as standard since only in one or two instances is material other than aluminum used for the case.

Regarding the transmission case, cost is cited as the only reason for the non-

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Accept Four S. A. E. Standards Reports

Standards Committee Approves Miscellaneous, Tire, Aeronautic Engine and Truck Control Reports—Headlight Glare and Military Truck Specifications Feature Discussions

Special to THE AUTOMOBILE

WASHINGTON, D. C., Oct. 18—Meeting to-day at the Bureau of Standards, the standards committee of the S. A. E. received reports from nine divisions and placed several new standards on the books for presentation to the Society for mail vote.

Conspicuous are recommendations regarding headlamps, the final report of the research division on the standard form for fuel economy and acceleration testing, revised testing forms for use in determining engine performance and standard controls for trucks.

Dr. Stratton, in his address of welcome, urged that the S. A. E. make full use of the facilities of the Bureau of Standards for tests and research and made a strong plea for the adoption of metric standards wherever possible.

Speaking of standardization in general, he congratulated the society on being in a new field and able to profit by experience in older fields. He stated that co-operation between practical and scientific men is necessary in working out standards and emphasized the value of scientific testing to intelligent standards work. He also urged uniform international units of measure in both scientific and practical fields. He considers the metric system best and believes that a change to that system is not so difficult or expensive as many believe. Dr. Stratton cited the Bureau's work on porcelain in spark plugs as an instance of its value to the automobile industry, determining physical properties of porcelain and investigating refractories. He asked for suggestions for co-operative work by bureau.

The Morning's Work

In the morning the reports of those divisions on which little discussion was anticipated were taken up. B. D. Gray, Hess-Bright Mfg. Co., chairman of the ball and roller bearings division, presented a report standardizing medium series, one direction ball thrust and recommending standard stock sizes for aeroplanes instead of special sizes.

Another report presented during the morning was by Henry Souther, chairman of the recently formed aeronautic engine division. This recommended adoption of the European taper propeller soft end which the U. S. Army and Navy has adopted. It is now used on the Hispano-Suiza engine by Simplex. This was opposed by C. M. Manly, Manly Drive Co., on the ground that improvements will be made too soon to make standardization worth while. Mr. Souther proposed standardizing the 18-mm. plug for aeroplane engines as the S. A. E. plug does not stand up under severe punishment for some unknown reason. The matter is now being studied. He also advised the adoption of the electric motor definition of engine rotation and reported progress on horsepower per pound ratings.

Mr. Souther's report was accepted with the amendment that the taper shaft end be held in abeyance.

Colonel Squier, in charge of the aviation section of the U. S. Army, spoke on the advantage of close co-operation between the engineers and the government department, saying that America wanted to avoid Europe's mistakes in aeroplane engines and plane specifications.

Augustus Post, of the Aero Club of America, announced that a Pan-American Aeronautical Exposition will be held at the Grand Central Palace, Feb. 8 to 16.

Standard sizes for battery jars have been under consideration by the electric vehicle division for some time, and agreement is not yet reached, so this division presented only a progress report showing that the subject is likely to be cleared up finally before the Winter meeting.

Chairman Whitney reported progress to reduce battery jar sizes from 200 to 41 with 32 in one height, 9 in another and lamp sizes from a host to nine, all one base type, three sizes, and three voltages. Progress on rubber tire efficiency tests and sizes of charging cables is waiting for reports from other electrical societies on cables.

Miscellaneous Report Accepted

A very excellent report was presented by J. G. Utz, consulting engineer Perfection Spring Co., and chairman of the miscellaneous division. This division has a very full program and a number of difficult subjects before it. The report contains only two new recommendations in final form, one relating to spark plug terminal thread and the other to the extension of rod ends.

The division recommended that 15/16-in. hex size for spark plugs replace ⅞, as many makers now use it because it allows greater porcelain thickness while the same spanners fit it. Terminal threads should be in two sizes, 5-40, Ford size, and 8-32 as the S. A. E. standard, the 8-32 to be the A. S. M. E.

A taper socket and plug for fender irons in thread sizes from 7/16 to ¾, all tapered 4½ in. per foot, was also presented. The division also submitted two standards for steering wheel hubs, straight for those with levers on the top of the wheel and tapered for those not at the top. There are four sizes of each, ⅞, 1¾, 2, 2¼, taper of 1 in. per foot. It was also recommended that no extension of rod ends beyond ½ in. be made, as the larger sizes are not needed for strength, but only for wear, which can be provided on smaller sizes by hardening the pins. Mr. Utz's report was adopted.

Tire Division Recommendations

The tire division recommended straight side tires from 32 by 3½ to 36 by 4½, as the larger straight sides are not practical. The smaller ones are on Fords and therefore the soft bead clinches. J. E. Hale, experimental engineer of Goodrich Tire & Rubber Co., amended this recommendation with a provision that straight sides be of the wide standard. The report was adopted.

Prof. Gallup's report on Proposed Standard Form for a Complete Car Performance Test was presented. This was only a progress report for the research division and will be final in January. The report follows:

Proposed Standard Car Performance Test

1—The entire test shall be made upon an automobile speedway or other course surfaced with wood, brick, concrete, asphalt or an equivalent material. Such speedway or course must have been approved for this purpose by the Council of the S. A. E. or an agent authorized by it.

2—The entire test shall be conducted by a competent and impartial referee approved by the Council of the S. A. E. This referee shall have complete charge of the test and he shall select such assistants as he may deem necessary. The referee shall certify to the results of the test before a notary public, who shall affix his seal thereto.

3—The entire test, including the fuel economy runs and the acceleration runs, shall be performed between sunrise and sunset of the same day.

4—The entire test may only be run at a period during which no appreciable wind exists, i. e., no wind which at any time exceeds a velocity of 15 m.p.h., measured at the nearest U. S. weather bureau station. The average values of humidity and barometer shall be obtained from the same source.

5—During the entire test the car must be run with all tanks full and carrying its full complement of passengers or corresponding ballast. Full complement of passengers shall consist of one passenger or the equivalent for each seat provided, driver included. The average weight for passengers and driver is to be 150 lb. each.

6—During the entire test there must be no change in gear ratio, ignition, carbureter, or any other detail of the car or its equipment. This shall not be interpreted as prohibiting changing spark plugs or manipulation of spark and throttle levers.

7—When a car is stated to be a stock

car it must be stock in every particular. Even though different carbureters, ignition systems, gear ratios or other details are optional on the same stock car, no change shall be made during the entire test.

8—A car fitted with an inclosed body must have all windows and doors closed during the runs.

9—A car fitted with an open body must have the top up and windshield fully erected during the runs. Rear curtains must be fastened down. Side curtains must not be used.

10—The pressure in the tires shall be that recommended by the manufacturer of the tires used, corresponding to the load applied both front and rear.

11—The highest gear only is to be used during the entire series of runs.

12—At no time during the runs shall coasting, declutching or the use of brakes be permitted.

13—Oils and greases used in the engine, transmission, rear axle or other parts of the car must be of usual quantity and quality.

14—The whole of the fuel used during the test must be of one quality. A sample of the fuel shall be taken for the purpose of determining and recording its specific gravity. The trade name of the fuel used shall be given. Wherever possible, information relative to its heat value shall be furnished, also a curve showing the results of a fractional distillation test.

15—All fuel used during the test must be fed from the special tanks placed on the windshield. (See description of apparatus under Fuel Economy Runs.)

16—Previous to beginning any run of the test, the engine is to be operated sufficiently long to bring it to the normal temperature corresponding to the conditions existing during that run.

17—The entire cooling system must be fully operative during the test, both as regards air and water circulation.

18—From the beginning to the conclusion of the entire test (including both the acceleration and economy runs) there shall be no manipulation of any carbureter adjustments or control other than the throttle.

Fuel Economy Runs

19—The fuel economy runs, when conducted upon a speedway, shall be made so as to complete each run at a point identical with that of starting. Each run shall be made without any interruption.

20—When conducted upon a course approximately straight, the runs shall be arranged so that each shall be completed at a point identical with that of starting. In each run there shall be no interruptions except those necessary for turning. Any such course shall have an exact length of 5, 2½ or 1 2/3 miles in one direction.

21—The fuel consumption shall be measured at a series of speeds covering the entire range of the car from the minimum to the maximum, following in general the outline in the table:

Run	M.P.H.
1	Minimum speed
2	9-11
3	14-16
4	19-22
5	26-30
6	35-40
7	47-55
8	63-70
9	Maximum speed

Note: In case the maximum speed is less than that indicated in any of the other runs the latter shall be omitted from the test. In any event, however, a run is to be made at the maximum speed of the car.

22—Fuel shall be fed to the carbureter during the runs by gravity and shall be supplied from a weighing tank mounted so that the actual distance between the top of the float chamber of the carbureter and the bottom of the fuel chamber is not less than 12 in. The tank shall be such that the variation in head during a run shall not exceed 12 in.

23—There shall be two tanks, preferably mounted side by side, as shown in the accompanying sketch. These tanks shall be connected to the carbureter so that by means of two cocks or their equivalent one tank may be "cut in" and the other "cut out" simultaneously. Of these two tanks, one is a reserve tank, used for maneuvering when measurement of the fuel is not being made. This tank may be a fixture if so desired. The other is a weighing tank, to be used during the runs for the measurement of fuel. This must be capable of easy detachment so that it can be weighed and replaced without difficulty. It must be large enough to contain fuel sufficient to enable the car to complete its run at maximum speed without refilling.

24—The procedure relative to the tanks is as follows:

Each tank is to be filled with fuel.

After filling, the weight of the weighing tank with fuel is to be accurately determined and recorded. It is suggested that a carefully calibrated spring balance be used. Following this the weighing tank is to be mounted in position.

The engine and car shall be brought to the normal temperature and speed of the run before crossing the starting line on fuel from the reserve tank. Upon crossing the starting line the reserve tank shall be cut out and the weighing tank cut in.

When the course is such as to necessitate interruptions in the run due to turning, the same procedure shall be repeated at each end of the course.

Upon crossing the finish line at the conclusion of each run, the weighing tank shall be cut out. It shall then be removed from its attachment and with its contents carefully weighed. The weight of the fuel consumed having been recorded, the tank may be refilled and weighed again previous to the commencement of the succeeding run.

25—Before the commencement of each run a setting of the throttle shall be determined which shall give the average speed desired for the run. During the run this setting shall remain fixed. The time for each lap is to be checked by the observer and in no case must the time of the slowest lap exceed that of the fastest lap by more than 10 per cent of the latter.

Acceleration Runs

26—The acceleration runs shall only be made on a straight portion of the course.

27—Each acceleration run shall start from a constant speed equal to the minimum speed obtained in the fuel economy runs and shall continue until the maximum speed of the car is reached.

28—There shall be ten such runs made consecutively over the same course, reversing the direction each time. The data from each of these runs shall be recorded. The final result shall be the average of the ten runs.

29—In determining the acceleration an electrical timing apparatus shall be used. This shall provide means for making or breaking an electrical contact at definite and equal distances on the course.

30—From the record of this apparatus shall be obtained data showing in the form of a curve the relation between acceleration in feet per second per second and speed of the car in miles per hour.

It was pointed out in the discussion that no allowance could be made for pressure or vacuum fuel feed. Owing to the difficulty in determining what a stock car is, Herbert Chase, chief engineer of the Automobile Club of America, suggested the stock car clause to be omitted. B. B. Bachman, Autocar Co.; A. L. Riker, Locomobile Co., and W. H. Conant, Gould Storage Battery Co., strongly objected to the council approving referees or courses, since that would be an indorsement of results of tests which would lead to misuse of the society's name in advertising. Eventually the report was accepted as of progress, with clauses 1 and 2 referred back for reconsideration. A test will be made before the winter meeting to try out the method.

Headlamp Glare

In the afternoon headlight glare and truck standards were the chief subjects discussed.

The matter of headlamps and glare was opened by Chairman Clayden, who read the address given on pages 674 and 675 of this issue. Following it, A. L. Riker, chairman of the electrical equipment division, read the report of the work done since June, which follows:

Electrical Equipment Report

1—Most of the more important work of the electrical equipment division has progressed nearly to the stage at which final reports can be made. A revision of the matter on Data Sheets 38a is presented herewith with the final approval of the division; also a recommendation for taillamp glasses. Recommendations relating to details of headlamps are given in tentative form, final action on the details being withheld to await trial under manufacturing conditions. If no unexpected difficulties arise, final action will be taken by the division within the next 1 or 2 months.

Taillamp Glasses — 2 — Investigation has shown that practically all makers of taillamps are using glasses having a nominal diameter of 3 in. with tolerance of minus 1/64 and plus 1/32 in. It is recommended that these dimensions be made standard.

3—In view of the different forms of dust-proof devices, as well as the use of flat and convex lenses, it is considered inadvisable to standardize headlamp glasses.

Size and Location of Headlamp Bulb Filaments—4—The tentative recommendations in regard to size and form of filaments for headlamp bulbs are as follows:

5—The vacuum bulb shall have a filament in the form of a helix of 2.5 mm. outside diameter and 4.2 mm. long, the axis of the helix coinciding with the axis of the bulb, as in the sketch.

6—The gas-filled bulb shall have a V-shaped filament (each leg of the V being formed of a fine helix) lying in a plane passing through the axis of the bulb and at 90 deg. from the plane of the locating pins in the base, with the apex of the V pointing away from the receptacle. The

(*Continued on page* 679)

Bad Truck Measures for N. J.?

Recommendations of Special Committee Would Practically Bar Trucks from State

NEW YORK CITY, Oct. 16—It will be commercially impossible to operate a motor truck in New Jersey if the recommendations of the special committee appointed by William L. Dill, Commissioner of Motor Vehicles of that State, are enacted into law.

Among the most glaring of the absurdities with which the committee seeks to burden the motor truck operator is one that each truck driver must carry waybills for each load, these waybills to show the gross weight and net weight carried. Another is that all commercial vehicles shall carry spare wheels, so as to avoid the possibility of any part of the steel rims coming into contact with the surface of the road should the rubber tires become damaged.

Nor were these two recommendations the only ones the committee, which is formed of engineers of several of the counties of the State, seeks to impose.

It also would limit the width of any truck over 4000 lb. weight to 96 in., outside measurement.

Another suggestion is that the extreme length of motor trucks shall not exceed 23 ft. 6 in.

Another suggested statute would make it prohibitory for a motor truck to be equipped with any tire covering of metal, or with any lugs or hobs or other sharp devices which would be in contact with the surface of the road, except non-skid chains.

Still another is that not more than one trailer shall be allowed to any commercial vehicle and that in every case the trailer shall be equipped with rubber tires.

Nor is this all, for the committee seeks to increase the truck registration fees from the present maximum of $25 to a maximum of $125.

—

Prest-O-Lite Gets Injunction

INDIANAPOLIS, IND., Oct. 16—Judge A. B. Anderson in Federal Court last week granted a permanent injunction in behalf of the Prest-O-Lite Co., of this city against O. K. Stuart, of the Sun Lite Gas Co., Alexandria, Ind., which forbids the latter from refilling Prest-O-Lite tanks.

—

Kent Plant in Belleville

BELLEVILLE, N. J., Oct. 17—The Kent Motors Corp. plans to establish a plant in this city costing more than $500,000 with potential capacity for 50,000 cars a year. The plant will be 125 by 400 ft. Work will soon begin on three structures, a factory, power house and assembly building.

—

Pullman Leases Sphinx Plant

YORK, PA., Oct. 12—The Pullman Motor Car Co., this city, has leased the entire plant of the Sphinx Motor Car Co., and will use it for making bodies and other sheet metal parts.

First Photograph of a British War Tank

The above illustration is the first authentic picture of one of the caterpillar armored tractors used by the British Army on the Somme front in France. This machine has been injured by shell fire, or otherwise, as one of the elliptical belts which provide traction is torn out of position as shown at the right. Powerful gears revolve the belts and the weight of the machine is carried on rollers which are set close together on the ground side. The large wheels shown in the rear do the steering and support the weight of the tractor when crossing a shell crater or trench, thus greatly increasing its mobile length. Each machine is fitted with three or four machine guns and can fire 2000 bullets a minute, according to reports from the scene of operations.

Photo by Underwood & Underwood.

Argentine Trade-mark Law—II

Definitions of Trade-marks and Copyright Classifications for the Automobile Industry

BUENOS AIRES, ARGENTINA, Sept. 15—There are several general considerations with regard to automobile trade-marks in the Argentina that should be kept in mind by U. S. A. automobile manufacturers in addition to those mentioned in THE AUTOMOBILE last week.

A trade-mark may consist of names of objects of persons in a special form; portraits, emblems, monographs, designs, borders, fancy words, letters, or numbers of special designs or forming combinations; containers or special form, etc.

Not registrable: Coats of arms, flags or other insignia of the Argentine nation. (By a recent ruling the coats of arms or flags of foreign nations may be registered by consent of the respective legation); the form of the product itself; the color of the same; terms or expressions which have become of general use; designations usually employed to indicate the nature or class of the products; immoral designs or expressions.

Procedure: On filing the application the description in duplicate accompanied by labels and an electroplate of the mark (not to exceed 3⅛ in. by 3⅞ in.) must accompany the petition, unless the mark consists of a "fancy word" only, in which case the electroplate may be omitted at option of applicant. The entire payment of Government fees for the term of 10 years is also paid ($50 Argentine) as well as the power of attorney in case the applicant is non-resident. The above mentioned fee together with the expenses of legalization and translation of power of attorney and $1 for each sheet of paper used during the entire prosecution of the case, including communications of the Office and replies to same, constitute the costs of the case, so that the agent or attorney who makes a fixed price is never sure of the exact amount of his profit, which at usual rates is little enough at the best. In case of rejection the first fee is returned at the cost of some more "stamped paper" and trouble on the part of the agent, or another mark may be substituted at a slight additional expense.

Publication: A few days after filing the mark is published during five consecutive days in the *Boletin Oficial* together with the name of applicant and the class of goods to be covered by the registration. After the last day of publication there is a statutory period of 30 days during which any persons deeming

(*Continued on page* 680)

Princess Cars in Production

Ten Cars a Day Present Output—$50,000 Worth of New Machinery

DETROIT, MICH., Oct. 17—Active production on the new models has started at the factory of the Princess Motor Car Co. The present manufacturing schedule calls for ten cars a day, and the product now being put out is provided in five different color combinations.

The line includes a five-passenger touring, three-passenger chummy roadster, and a raceabout. The cars are equipped with a Golden, Belknap & Swartz engine, with Grant-Lees clutch and gearbox. There is a floating axle of Princess design and 32 by 3½ tires. The bore and stroke is 3¾ by 4¼ and the chassis has a wheelbase of 108 in. Disco lighting and starting is used, this being a two-unit system. For ignition, a Splitdorf-Dixie magneto is fitted. Featuring the equipment is a fuse box on the dash which is unique in a car of this price. Another special point in the fitting of the car is that nothing but genuine leather is used in the upholstery.

The Princess plant has recently been completely overhauled and $50,000 worth of new machinery is just being installed. The new models which sell for $775 are being delivered regularly.

—

Willard Completes New Building

CLEVELAND, OHIO, Oct. 14—The Willard Storage Battery Co. has just completed the first of its new buildings at the plant located at 274 East 131st Street.

This building will be occupied by the forming rooms which have previously been located at the old plant, corner Marquette and Lakeside. The building contains 90,000 sq. ft. and is of the very latest and most approved type of construction.

Work has been started on the second building, which will be two stories and will contain 75,000 sq. ft. This building will be occupied by the factory office, machine shop and storeroom.

—

Mickim Heads Liberty Advertising

DETROIT, MICH., Oct. 17—Robert Mickim, formerly advertising manager of the Ford Motor Co. of Canada, has been appointed advertising manager of the Liberty Motor Car Co., to succeed H. L. Buller, whose resignation took effect last week.

—

Jordan to Double Capacity

CLEVELAND, OHIO, Oct. 16—Plans are now being prepared for the Jordan Motor Car Co. for the erection of a new building, which will double its factory capacity.

The Jordan company started deliveries Aug. 15, and to date have produced and delivered at the average rate of eight daily for the whole period, and the daily production now is ten.

The new building will be of the same size as the original, occupying 30,000 sq. ft. of floor space, and will be erected for occupancy late in the winter or early in the spring.

It is understood the new building will be used for body mounting and final assembling and inspection. At present the Jordan company is using a tent to take care of the overflow.

—

18,000 Grants for 1917

CLEVELAND, OHIO, Oct. 14—The directors of the Grant Motor Corp. met in Cleveland, yesterday, and declared the regular 1¾ quarterly dividend on preferred stock, payable Nov. 1 to holders of record Oct. 15.

The board passed on and authorized the building of 18,000 cars for the year beginning Feb. 1, and the production is expected to be 20,000 before 1917.

—

Velie Production Increased 300%

MOLINE, ILL., Oct. 17—The factory production of the Velie Motor Vehicle Co., this city, has increased 300 per cent. Four of the Velie buildings are now occupied by the passenger car department.

The increase in production of the truck department over that of a year ago is 260 per cent.

British Makers Fear U. S. A. Cars

Boycott Suggested—Must Keep Enlarged Car Plants Busy After War

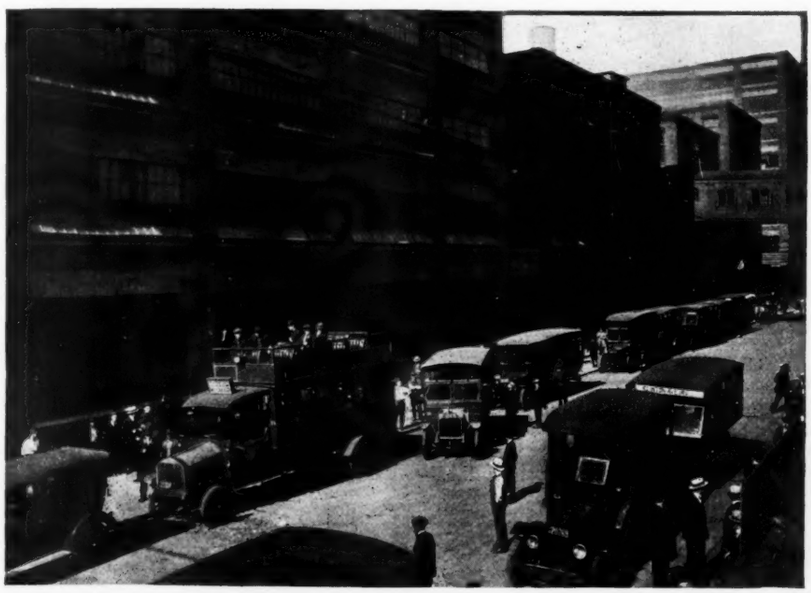
LONDON, ENG., Oct. 7—The recent announcement that the Ford company would establish a plant in England has brought forth proposals to boycott the low-priced American car. It has been suggested that all cars not manufactured in the allied countries be excluded from the British markets after the war.

The war has been the cause for great factory expansion and though the plants at present are busy on munition work and are well equipped with tools and appliances for taking care of a large production, the future use of these immense buildings has been a great source of worry to the country. The British automobile industry is particularly well equipped for rapid production, and so there seems no reason why it should not, in a very short time after the war, produce the desired cheap cars so as to repel the American invasion.

British automobile makers hold that some such agreement should be reached on the ground that as soon as the war is over and freights drop to normal Europe stands a great chance of being flooded with cheap American cars selling from $250 upward.

Up to the present time the British au-

Jitneys Handle Overflow of Hyatt Workers



Jitney buses lined up outside the factories of the Hyatt Roller Bearing Co., Newark, N. J., to take the overflow of workers home. This line-up is a regular occurrence at the plant, morning, noon and night. Fares are 5 cents, and the buses have regular routes designated by signs which they carry. The Hyatt company is one of the units of the United Motors Corp. and employs 5000 persons

tomobile manufacturers have paid scant attention to the little car, for the reason that they have had more orders for their high-priced cars than they could execute. Conditions are changing, however, and the European trade is awakening to the possibilities of the low-priced car in that market.

—

Dividends Declared

Willys-Overland Co.; quarterly of 75 cents a share, payable Nov. 1 to stock of record Oct. 23.

Kelsey Wheel Co.; quarterly 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 16.

Pennsylvania Rubber Co.; 1¾ per cent on preferred and 1½ per cent on common, payable Jan. 1 to holders of record Dec. 15.

Fisher Body Corp.; quarterly of 1¾ per cent on preferred payable Nov. 1 to stock of record Oct. 17.

Bower Roller Bearing Co.; quarterly of 15 per cent, making 45 per cent cash dividends so far this year. Also a stock dividend of 100 per cent recommended to be passed on at annual meeting in January.

Globe Rubber Tire Mfg. Co., semi-annual of 3½ per cent on preferred, payable Nov. 1, to stock of record at close of business Oct. 27.

Reo Motor Co., extra of 7½ per cent and quarterly of 2½ per cent, payable Nov. 1 to stock of record Oct. 16.

Nash Motors Co., initial quarterly of $1.75 per share on preferred, payable Nov. 1 to stock of record Oct. 20.

Hood Rubber Co., quarterly of 1¾ per cent on preferred, payable Nov. 1 to stock of record Oct. 27.

—

Bower Recommends 100% Stock Dividend

DETROIT, MICH., Oct. 14—After declaring a quarterly dividend of 15 per cent the directors of the Bower Roller Bearing Co. recommended that a stock dividend of 100 per cent be approved by the stockholders at their annual meeting in January.

Gasoline Pumps Are Inaccurate

—

Over 5,000,000 Gal. Lost in West as Result of Short Measuring

CHICAGO, ILL., Oct. 16—Two matters featured the gasoline situation in the Central West this week, one being a rather general drop in prices, and the other, charges of short-measuring pumps. In Chicago, gasoline is selling at 15.6 cents a gallon, which is a drop of 1 cent since the first week in October. The same price prevails at Milwaukee, the Standard Oil being the first to cut the price 1 cent which was met by the independents.

Reports coming from Bloomington and other Illinois cities indicate that the price of 15½ cents a gallon is rather general throughout the State. The city motorists now have to pay 16½ cents per gallon, whereas they were paying 17½ up to Oct. 10.

Approximately half the gasoline troughs that have been inspected in Chicago since June 12 have been condemned, 956 inspections having been made to date. Government inspectors are working with the city forces.

Results of an investigation of gasoline measuring pumps in Illinois made by the United States Bureau of Standards show that in tests conducted in Chicago and typical suburban and rural communities downstate, the Government inspectors found 82 per cent of the Chicago gasoline pumps, and 83 per cent of those outside Chicago, inaccurate. The averaage shortage was 3.9 cu. in. per gallon in Chicago, and 7 cu. in. per gallon downstate. It is estimated that this shortage means a loss of more than 5,000,000 gal. per year, or $1,000,000 at the present price of gas in Illinois. A tolerance of 0.1 cu. in. per gallon is allowed. Gasoline users in the Twin Cities are getting full measure according to a recent inspection of pumps in Minneapolis and St. Paul.

The Bureau of Standards of the Department of Commerce recently published a report pertaining to the accuracy of liquid measuring pumps in which it states the principal causes of short delivery are caused by leaks in valves or piping; formation of vapor due to excessive suction lift, or the introduction of air under the pistons; failure to correct for the inertia of a long column of moving liquid; the use of long filling hoses with a low connection at the pump making proper drains of holes an impossibility; operation of pump at less than full stroke; and slippage past valves and pistons.

—

New Polack Truck Tire Organization Formed

NEW YORK CITY, Oct. 14—The Polack Truck Tyre Corp. has been organized to take over the assets and business of the Polack Tyre & Rubber Co., Bridgeport, maker of solid rubber tires for commercial vehicles.

The new company is offering through E. B. Eames & Co., this city, 40,000 shares of stock at $12.50 per share out of a total capitalization of the company of 100,000 shares, no par value.

The refinancing plan provides the funds for the erection of a new plant. It is estimated that when the new plant is completed the company will earn about $3.50 a share. The stock, it is stated, will be listed on the New York Curb and the Cleveland Stock Exchange.

—

Massnick Mfg. Co. Now

DETROIT, MICH., Oct. 16—The Massnick Mfg. Co. is the new name of the Massnick-Phipps Mfg. Co. There has been no change in the stock ownership or control and the management remains the same.

—

Crude Oil Higher

NEW YORK CITY, Oct. 18—The materials markets last week were featured by a gain of 10 cents a barrel in Pennsylvania crude oil, which rose to $2.50. The principal purchasing agencies are continuing their efforts to bring to the refineries the large quantities of crude oil now in the hands of the producers, and as a result have raised prices to induce the holders to sell. It is stated that the producers are hoarding the supplies.

Steel prices still hold at $45 per ton on both Bessemer and open-hearth. Beams and channels quote at $2.87 per 100 lb. Automobile makers are actively in the market for soft steel bars for shipment over the first half of 1917. Much difficulty is experienced in having contracts accepted. Several of the Detroit makers are now in the market for about 50,000 tons of bars in the aggregate. All

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.11¼	.11¼	.11¼	.12¾	.12¾	.12¾	+ .01½
Antimony, lb.	.65	.65	.65	.65	.65	.65	...
Beams and Channels, 100 lb.	2.87	2.87	2.87	2.87	2.87	2.87	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	11.65	11.80	11.80	12.15	12.10	12.05	+ .40
Fish Oil, Menhaden, Brown, gal.	.58	.58	.58	.60	.60	.60	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.08	1.08	1.08	1.08	1.08	1.08	...
Lead, 100 lb.	7.05	7.05	7.05	7.05	7.05	7.05	...
Linseed Oil, gal.	.82	.82	.82	.82	.82	.82	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.50	2.50	2.50	2.50	2.50	2.50	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.73	.72	.72	.72	.72	.72	— .01
Rubber, Ceylon First Latex, lb.	.64	.63½	.63½	.63½	.62½	.62½	— .01½
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.00	42.25	42.25	41.75	41.75	41.25	—3.75
Tire Scrap, lb.	.06	.06	.06	.06	.06	.06	...

the steel mills are filled up and can take little additional business except for delivery in the far future.

Crude rubber prices have softened after a temporary stiffening, due to the activities of the German submarine. Trading was light. Up-river is selling at 72 cents a pound, spot, while for November-December delivery the quotation was 68½ cents. The wide margin was said to be due to the fact that only one boat carrying Brazilian rubber is scheduled to arrive here this month.

—

Hoover Steel Ball Grows Fast

DETROIT, MICH., Oct. 16—The recent meeting of the directors of the Hoover Steel Ball Co. of Ann Arbor has revealed the phenomenal growth of the company. The capital stock of the concern, which makes steel balls for machinery, was increased from $500,000 to $1,800,000.

The concern came to Ann Arbor in 1913, being the old defunct Flanders company ball bearing department. It started with floorspace of 29,000 ft. and thirty-two employees and annual sales of $163,000 the first year. Floorspace is now 112,506 sq. ft., there are more than 700 employees and the sales record up to July 31 is $1,310,001. Dividends to the amount of $264,975 cash, and stock dividends of $150,770 have been made to-date, and according to the company's report every stockholder has received back his original investment in dividends.

The company has on its books now, orders for 400,000,000 ¼-in. basis balls which are as yet unfilled.

Security Prices Advance

General Motors, Chevrolet and United Motors Rise on Good Market

NEW YORK CITY, Oct. 18—Despite bearish activities, automobile and accessory issues last week held strong, and holders of these issues on margin netted large gains on a number of the stocks. General Motors on the Stock Exchange and United Motors on the Curb featured the week's activities with gains of 40 and 5 points, respectively. Although trading in such an expensive issue as General Motors is necessarily restricted, the behavior of that stock in the last few days seems to indicate that stockholders are inclined to look favorably on the new reorganization plan presented by the directors. On Monday the stock opened at 760 and closed at 779½, and yesterday there was a further advance to 790, the highest price the stock has ever touched; in fact, the highest price any stock listed on the Stock Exchange has ever reached in the regular way of trading.

United Motors has been subjected to much short-selling. Speculators believed that it would decline on account of the submarine scare, but the stock has steadily risen on account of heavy outside buying and as a result those holding the stock on margin were treated to a gain of $5 a share for the week. Rumors state that this stock is slated to go much above 100 before Christmas.

Several of the tire issues were strong and higher. Firestone continued on its skyward movement and reached 1125, a gain of 5 points; Fisk common rose 5 points; Miller Rubber rose 5 points; and the rest of the issues rose fractionally.

Activities on the Detroit Exchange, on the other hand, were mainly subject to short selling. Prices were lower. General Motors dropped 10 points; Maxwell declined 8 points; Studebaker dropped 6½ points; other losses ranged from a fraction to 5 points.

—

Kelly Truck Capital $7,000,000

COLUMBUS, OHIO, Oct. 13—The Kelly-Springfield Motor Truck Co., has filed papers with the Secretary of State increasing its stock from $1,740,000 to $7,000,000. The shareholders have ratified the increase. The shares will be divided as follows: Common, $2,000,000, against $900,000, formerly; preferred, $5,000,000, compared with $840,000.

—

Republic Rubber Enlarges

YOUNGSTOWN, OHIO, Oct. 14—The Republic Rubber Co., this city, has offered 10,475 shares of its common stock pro rata, at par, to its common stockholders. The proceeds, about $1,000,000, will be used for working capital and extensions.

The members of the executive committee of the board of directors have asked the stockholders to waive their rights to subscribe to an additional 5000 shares of common stock. It is understood that this block of stock will be held for dis-

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	63	65	— ½
J. I. Case T. M. Co. pfd.	82	88	..
Chalmers Motor Co. com.	95	105	—35
Chalmers Motor Co. pfd.	92	96	+3
*Chandler Motor Car Co.	104	105½	..
Chevrolet Motor Co.	195	198	+5
Fisher Body Corp.	40½	42½	—1½
Fisk Rubber Co. com.	95	100	+5
Fisk Rubber Co. 1st pfd.	112	115	+2
Fisk Rubber Co. 2d pfd.	100	110	..
Firestone Tire & Rubber Co. com.	1125	1150	+5
Firestone Tire & Rubber Co. pfd.	110	111	..
*General Motors Co. com.	730	780	+40
*General Motors Co. pfd.	122½	123¾	—3½
*B. F. Goodrich Co. com.	73	73⅛	+ ⅝
*B. F. Goodrich Co. pfd.	113¾	114	+ ½
Goodyear Tire & Rubber Co. com.	296	298	..
Goodyear Tire & Rubber Co. pfd.	107¼	108½	+ ¼
Grant Motor Car Corp.	7	10	—1¼
Hupp Motor Car Corp. com.	5¼	6	..
Hupp Motor Car Corp. pfd.	80	100	..
International Motor Co. com.	4	7	+ ½
International Motor Co. pfd.	18	22	+3
*Kelly-Springfield Tire Co. com.	77	78	—2½
*Kelly-Springfield Tire Co. 1st pfd.	97	100	—1
*Lee Rubber & Tire Corp.	43	44	— ½
*Maxwell Motor Co. com.	89	89½	—1
*Maxwell Motor Co. 1st pfd.	86½	87	+ ⅜
*Maxwell Motor Co. 2d pfd.	55	56	—1½
Miller Rubber Co. com.	240	250	+10
Miller Rubber Co. pfd.	104	106	..
Packard Motor Car Co. com.	170	190	+5
Packard Motor Car Co. pfd.	98	104	+3
Paige-Detroit Motor Car Co.	38	39	+2
Peerless Truck & Motor Corp.	22½	24½	—1
Portage Rubber Co. com.	174	176	+1
Portage Rubber Co. pfd.	173	174	..
Regal Motor Car Co. pfd.	17	22	..
Reo Motor Car Co.	44½	45¼	..
Saxon Motor Car Corp.	78	79	+ ¼
Springfield Body Corp. com.	90	100	..
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	7½	8	..
Stewart-Warner Speed. Corp. com.	115	117	+2
Stewart-Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	131½	132½	..
*Studebaker Corp. pfd.	110½	111½	+1¼
Stutz Motor	65	66½	..
Swinehart Tire & Rubber Co.	85	90	..
United Motors Corp.	67½	69½	+5
*U. S. Rubber Co. com.	59	59¼	+ ⅞
*U. S. Rubber Co. pfd.	112½	112⅞	—1¼
White Motor Co.	56½	57½	+1½
*Willys-Overland Co. com.	44¾	45	+1
*Willys-Overland Co. pfd.	102½	103	+ ¼

*At close Oct. 16, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	41	43½	..
Chalmers Motor Co. com.	95	106	..
Chalmers Motor Co. pfd.	..	95	..
Continental Motor Co. com.	36¾	37½	— ¼
Continental Motor Co. pfd.	9½	10½	..
Ford Motor Co. of Canada	..	305	..
General Motors Co. com.	700	760	—10
General Motors Co. pfd.	121	125½	—5
Maxwell Motor Co. com.	83½	86½	—8
Maxwell Motor Co. 1st pfd.	84	87	—2
Maxwell Motor Co. 2d pfd.	53	56	—3½
Packard Motor Car Co. com.	..	180	..
Packard Motor Car Co. pfd.	..	102	..
Paige-Detroit Motor Car Co.	37½	38½	..
W. K. Prudden Co.	..	50	..
Reo Motor Car Co.	44¼	45¼	+ ¼
Studebaker Corp. com.	127	130	—6½
Studebaker Corp. pfd.	107	..	..
C. M. Hall Lamp Co.	28½	30	+ ½

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	18	..	..

position by the directors in the future development of the company.

The additional stock issue is equivalent to 40 per cent of the present outstanding common stock which is $2,500,000. The outstanding preferred amounts to $3,450,000.

—

Selden Truck Sales Gain 258 Per Cent

ROCHESTER, N. Y., Oct. 14—An increase of 258 per cent was made by the Selden Truck Sales Co., this city, in the period of 8 months, extending from Jan. 1 to Aug. 31. September shipments of 1916 increased 121 per cent over the same month in 1915.

—

Canadian Ford Co. Earns 15.8 Per Cent

DETROIT, MICH., Oct. 13—The net earnings of the Ford Motor Co. of Canada, Ltd., for the fiscal year of 10 months ending July 31, after deduction of $716,136 for special war taxes, were $1,109,322.14. The net earnings are equivalent to 15.8 per cent on the outstanding $7,000,000 of the company's authorized $10,000,000 of capital stock.

The net earnings for the latest year prior to the war tax deductions were $3,202,000 for a full year of 12 months ending in 1915.

Difficulties in obtaining vessels for export business reduced earnings.

—

Everitt Tractor Tried Out

DETROIT, MICH., Oct. 13—B. Everitt has recently given his Everitt tractor a series of tests through Michigan farms. Hundreds of acres have been turned up, and in one test 11 acres were plowed in 9½ hr.

Resta in Lead for Championship

—

Chicago Victory Brings His Total in the Ranking of Drivers to 3200

NEW YORK CITY, Oct. 17—Dario Resta now leads the list in the 1916 racing championship with a total of 3200 points, having pulled himself out of second position by his victory at Chicago last Saturday, which netted him 800 points, enough to nose out Aitken, the former leader. The latter is now second in the standing with 2940 points.

The order of the championship standing is:

Resta	3200	LeCain	120
Aitken	2940	Oldfield	80
Rickenbacher	2210	Taft	75
De Palma	1790	Pullen	70
D'Alene	1120	Haibe	60
Milton	690	Stringer	55
Mulford	620	Adams	55
Lewis	600	Cooper	55
Christiaens	540	Gable	45
Henderson	517	Wilcox	40
Vail	450	Chandler	40
Galvin	385	Watson	35
Devigne	320	Sorensen	35
Hughes	275	Johnson	30
Buzane	210	Devore	30
O'Donnell	185	McCarthy	25
Devlin	140	Muller	20
Klein	125		

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Cadillac Breaks Record Across Iowa

DES MOINES, Ia., Oct. 14.—H. R. Wells of Des Moines drove a Cadillac eight across Iowa over the River-to-River Road on Oct. 11 in 7 hours and 49 min. The total distance covered was 331.2 miles and the miles per hour elapsed time was 42.37. This new record is 50 min. better than the previous mark made in September by W. J. Barndollar in a Packard twin-six over the same route in 8 hr. and 39 min. The same route was used also by Mulford in his recent runs across Iowa. Wells drove a touring car with top and windshield up and carried three passengers. He left Davenport at 6:37 a. m. and was checked in at Council Bluffs at 2:26 p. m. The last 142 miles of the run was covered at the rate of 44 m. p. h. Wells set a cross-Iowa record of 9 hr. and 14 min. 3 years ago and this stood until the Barndollar record of last month which was over a shorter mileage than that covered by Wells in his old record.

—

Myle-Mayker Gives 26.6 M.P.G. on Ford in A. A. A. Test

CHICAGO, ILL., Oct. 16—In a test held under the supervision of the American Automobile Assn. a Ford car was driven 26.6 m.p.g. after being equipped with a Myle-Mayker, produced by the Myle-Mayker Co., this city. The car, weighing 2267 lb., with four passengers and the top and windshield up, first made 22.5 m.p.g. without the Myle-Mayker. The addition of the Myle-Mayker, which was attached to the standard carbureter in about 1½ min., increased the mileage to 26.6. Acceleration tests without the device gave an increase from 7.5 m.p.h. to 30 m.p.h. in 24 sec. With the Myle-Mayker the same increase was made in 22 sec.

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Allen Adds Two Closed Models

FOSTORIA, OHIO, Oct. 16—The Allen Motor Co. has added two closed models to its line. These are a coupé, at $1,075,

Brown-Lipe-Chapin Co. Sold to United Motors

(*Continued from page* 641)

wealthy Syracuse capitalists connected with the Smith-Premier typewriter company. The connection of these gentlemen with Brown-Lipe-Chapin has been that they have owned approximately one-half of the stock, the remainder being held by C. W. Mott and his General Motors associates.

This latest purchase gives the United Motors Corp. a strong array of seven large progressive manufacturing organizations, each of which is continued as separate manufacturing concerns. The list to date includes: Hyatt, New Departure, Delco, Remy, Perlman, Klaxon and Brown-Lipe-Chapin. Some conception of the magnitude of these different concerns may be had from detailed figures on each.

The Dayton Engineering Laboratories occupies seven buildings and has 11 acres of floor space. Last year it produced 142,500 Delco installations and aims at 250,000 for next year. On July 15, 500,000 Delco installations were in use.

The Hyatt Roller Bearing Co. occupies twenty-one buildings with a total of 900,000 sq. ft. floor area. It employs 5000 persons and has a daily capacity of 40,000 roller bearings. Over 7,500,000 Hyatt bearings were furnished to the automobile industry in 1916 and it is estimated that 10,000,000 will be furnished for 1917.

The New Departure Mfg. Co. is manufacturing 21,000 bearings per day and by July 1 hopes to have capacity for 30,000 to 35,000 per day. The company is at present operating two factories, the major one at Bristol, Conn., and one for small bearings at Hartford, Conn. Its factory capacity will be doubled by July 1.

The Remy Electric Co. has a plant of twent-nine buildings with a floor area of 169,000 sq. ft. or equivalent to 4¾ acres. The present output is 950 ignition systems per day to which must be added 400 generators and 350 starting motors. This year's production will total 410,000 ignition systems and 125,000 starting and lighting systems.

The Perlman Rim Corp., a recent incorporation, followed the court decision on the Perlman rim patent rendered some months ago. The company secured the plant of the Jackson Rim Co., the capacity of which is being doubled, to give a total floor area of 129,400 ft. Some months ago the factory capacity was 2000 sets of rims or 10,000 individual rims per day. This capacity is being increased by new buildings which are now in course of construction.

The Brown-Lipe-Chapin Co., making differentials entirely, employs upward of 2000 workmen, and is the largest differential making concern in the world.

Lovell-McConnell Mfg. Co., manufacturer of Klaxon horns, was purchased in September, and plans made to double the production schedule.

and a convertible five-passenger sedan at $1,095. The sedan is a convertible type in which the roof is permanent and the windows and door fillers can be removed and put out of sight in a compartment back of the rear seat. Both cars are mounted on the standard Allen chassis.

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Five Moon Closed Models

ST. LOUIS, MO., Oct. 12—The Moon Motor Car Co., this city, will build five closed body models which will be ready for delivery in November, as follows:

Model 6-43—touring with demountable top, $1,450.
Model 6-43—cabriolet, seats three people abreast and one on drop seat, $1,850.
Model 6-66—cabriolet, seats three people abreast and one on drop seat, $2,150.
Model 6-66—coupe, seats three people abreast and one on drop seat, $2,150.
Model 6-66—sedan, with sloping windshield, single door at each side, and seven-passenger capacity, of Springfield metal body type, $2,250.

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Firestone Holds Sales Convention

AKRON, OHIO, Oct. 15—The Firestone Tire & Rubber Co., this city, is holding its annual sales convention this week, starting Oct. 17 and continuing for 3 days. About 500 salesmen and agents of the company will be in attendance.

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Packard Opens Used Truck Department

NEW YORK CITY, Oct. 18—The Packard Motor Car Co. of New York, has opened a used motor truck department at 239-241 West Fifty-sixth Street.

New G. E. Rectifier at Show

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Small A.C. Device at Electrical Exposition Uses Argon —Other Exhibits

NEW YORK CITY, Oct. 14.—Several new things of interest to automobilists are exhibited at the Electrical Show at Grand Central Palace. One is a new small-capacity alternating current rectifier shown by the General Electric Co. An entirely new principle is used, the gas in the bulb being argon instead of mercury vapor. It has several advantages over the mercury arc rectifier. It is inherently self-starting; 25 per cent cheaper to build and operate; slightly more efficient; more compact; requires less auxiliary apparatus, and most important of all, it can be made in very small sizes, for charging even a single storage battery. At present it is made in two capacities, 2 and 6 amps. The smaller delivers 1 amp. at 15 volts or 2 amps. at 7.5 volts. The price is $14. The larger is 75 volts and will charge up to thirty cells or ten three-cell batteries. It is equipped with an ammeter and sells for about $100.

Detroit Electric Lowers Price

The price of the Detroit electric has been reduced to $1,775, and a four-passenger body fitted, seating three on the rear seat. In all essential details the machine is the same as its predecessor. It has a forty-two-cell battery, wheelbase is 100 in., tires are 34 by 4½. Standard color is cobalt blue with wire wheels in white, cream, red or blue, as desired by the purchaser.

New 6-Ton G. V. Truck

A 6-ton heavy-duty truck is a new model shown by the General Vehicle Co., L. I. City, N. Y. It has a particularly convenient demountable battery cradle which is so designed that it may be removed either by dropping into place or sliding out to one side. Its speed is 6 m. p. h. and it will operate about 30 miles on a charge, having a forty-four-cell G. V. X. battery. Price is about $5,300 with body. An interesting feature of the body shown, which was for delivering coal, was the use of a Wood hydraulic hoist, driven by an electric motor, permitting the driver to raise the body and discharge its load without leaving the seat.

—

Hupp Tour Reaches Far West

DETROIT, MICH., Oct. 16—The United America Hupmobile is nearing Seattle after traveling over snow-covered mountains on the trail between Billings, Mont. and encountering several heavy storms. After reaching Seattle the tourists will turn southward and travel as far as Los Angeles.

N. Y. S. A. E. To Discuss Aluminum

(*Continued from page* 643)

universal employment of aluminum.

Concerning aviation motors, the employment of aluminum is carried to the limit. A word or two is devoted to the comparison of the aluminum with the pressed steel construction being tried out on a few experimental motors. Mention is made of the trend toward having the crankshaft lie well within the case, that is, with the crankshaft center line well above the plane of the bottom of the case. The advantages of the cast aluminum band over the steel stamping are mentioned.

The next matter considered is the use of aluminum in the rear axle. Prophecy is made that a great deal more attention is going to be devoted to this question of the reduction of unsprung weight within the next 2 or 3 years than ever before.

The balance, and by far the greater part of the paper is devoted to the employment of aluminum for cylinder construction. The matter is considered historically at the outset. It is pointed out that apparently Europe has stolen the march on this country in the actual production in quantity of aluminum motors, the Hispano-Suiza motor being cited.

A paragraph or so is devoted to answering various questions that have in the past been asked regarding the differences in behavior between an aluminum and a cast-iron motor. The discussion of types of motor is then taken up. Practically every conceivable type of motor has been made, poppet valve, rotary valve and sleeve.

Pistons come in for some attention. That the aluminum piston is the ultimate is very strongly emphasized. Troubles which developed with them are characterized as growing pains. The tendency to carry weight saving to the limit in the aluminum alloy piston is deplored and a saving of 100 per cent should be well worth while. The advisability of the employment of a long piston is receiving attention. The rule is laid down that the length should be equal to 1 1/3 the piston diameter proportions which were advocated in a paper given by the author last November before the society. The motor should be built around the piston and the employment of aluminum pistons should not be an afterthought.

Some little space is devoted to the employment of cast aluminum panels in motor car body construction. The advantages that this type of construction possess are touched upon.

The minor aluminum castings used about a motor car are given some consideration, more particularly the aluminum brake shoe is discussed. A paragraph or so is devoted to the comparative machining of aluminum and cast iron together with some allusion to relative costs. The paper is concluded with a few do's and don'ts that the engineer should bear in mind when designing an aluminum structure. Great stress is laid on the wisdom, in fact, necessity that the engineer should at all times be in very close touch with the foundry when designing structures of this sort.

In the concluding paragraph the fact that the output of aluminum is from 283 lb. in 1886 to 136,400,000 lb. in 1914 is mentioned and an analogy is drawn between that and the development of iron. The paper is accompanied by eighty lantern slides emphasizing some of the points brought out in the paper as well as showing some of the typical castings being produced to-day.

The Automobile

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Taxicab Design

SOME years ago there was a prevalent idea that the manufacture of taxicabs was going to be a profitable undertaking, but experience soon showed that this was not the case in a general way. At present there is an immense demand for good cabs, and practically no supply worth talking about.

The taxicab stands half way between the private car and the truck. It must be capable of being handled roughly, yet it has not any great loads to carry. It must have an engine that will be economical of fuel and the chassis and body must be light enough to permit a good tire mileage without being so light that they will give way under the bumps and bangs of taxi chauffering.

More than one taxicab company has tried many sorts of standard touring chassis, and found weaknesses in them all, with the result that it is not uncommon to find these concerns now building their own cabs, using some stock parts and some special ones.

In Europe, much the same state of affairs prevails. The most successful taxicab company in the world is in London. Originally it equipped with French and British chassis costing about $2,000 each, and built special bodies for them. Then, as weakness developed, the repair department was enlarged into a factory, and new parts made to new design, the resulting vehicle being a compromise between the British and French originals with new engineering added.

A taxicab cannot be built cheaply if it is to remain in use for year after year. The service calls for the best workmanship and the best materials, but there should be room in the American industry for a taxicab specialist manufacturer who is not afraid to ask $2,500 for his cab, or even more.

More Standards

THE session of the S. A. E. standards committee, held at the Bureau of Standards, in Washington, on Oct. 18, is not, in many ways, the most important yet, because, for one thing, the number of new proposals to be passed upon is not great. Still, the place of meeting will mark the occasion in the annals of the society.

Engineering standardization began as a thing altogether separate and apart from National standardization. There is a fundamental difference between the standard of money and the S. A. E. carbureter flange standard, for example. However, some engineering standards are national, like the U. S. screw thread, and more will be in the future.

Standards which are law, and hold for all time, are one thing; standards which are custom by agreement, and may have to be changed from time to time, are different; but there is no sharp dividing line. The enormous amount of work done in the past 10 years by engineering societies is obtaining recognition by the governments of the world; governments and the engineering industry are helping each other more than ever before.

Of the total of work done by societies, that belonging exclusively to the S. A. E. stands very high, and lately the S. A. E. and the Bureau have had to consider common subjects simultaneously, and it is probable that the relationship will be much closer in the near future.

The Spotlight

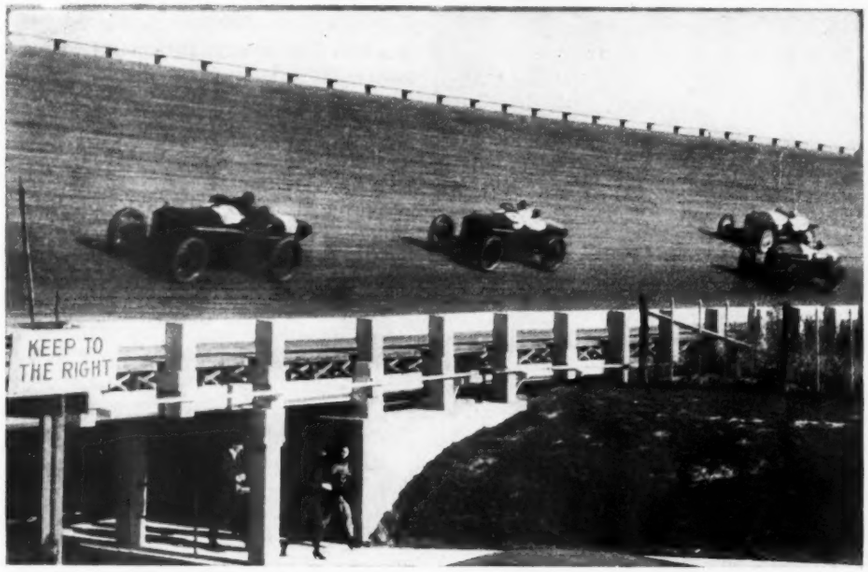
THE use of a spotlight has for many years been forbidden absolutely by the law of Great Britain, because of the power for annoying other road users that it gave a driver. There are signs that similar prohibition may be adopted by several of the States in the Union for the same reason.

The situation is regrettable. The spotlight is really very useful. For reading a sign, for examining a turn in the road, or for driving on a very bad and dangerous highway, where a strong light on the edge of the road is necessary, the spotlight is ideal. If it were only used in this way, in the way its originators intended it to be used, we should hear no complaints; but as things are, the avoidance of a difficult situation appears almost impossible.

The abuse of the spotlight is complicating the glare problem to quite a perceptible extent; it is making the work of those who are really solving the glare matter harder than it needs be. What a pity it is that the abuse of a good thing by a minority of fools should place its existence in jeopardy!

Resta Wins 250-Mile Grand American

Averages 103.99 M.P.H.—Aitken 6.93 Sec. Behind



Aitken, DePalma, Resta and Hughes in a brush early in the race

Prize Winners in the Grand American Race on the Chicago Speedway

Car	Driver	M.P.H.	Prize
Peugeot	Resta	103.99	$6,000
Peugeot	Aitken	103.65	3,000
Maxwell	Rick'bacher	102.08	1,500
Premier	Lewis	98.37	1,000
Maxwell	Henderson	98.34	900
Premier	Galvin	97.81	800
D'senberg	Devore	90.58	600
Ogren	Burt	86.66	500
Erbes	Gable	81.13	400
Hudson	Vail	80.81	300

CHICAGO MOTOR SPEEDWAY, Oct. 14—By the narrow margin of 6.93 sec. Dario Resta continued his unprecedented record of winning every big event on the Chicago Speedway to date. In to-day's 250-mile Grand American race he finished victor with this slender lead over John Aitken, thereby getting back first place in the ranking for the speedway championship of the season. Winning to-day's race, the closest ever witnessed on this speedway, gives Resta 3200 points, while Aitken, who was in the lead up to this afternoon, is now second with 2940. Resta broke his own record of 97.70 m.p.h. for 250 miles on this track.

The race resulted in a three-cornered battle for supremacy between Resta, Aitken and Rickenbacher, who finished third. Resta made but one stop at the pits, changing a right rear tire and taking on gasoline at the 190th mile in 28 sec. This was neither as thrilling nor as costly as Aitken's only pit visit, which occurred shortly after. With a lead of only half a lap over Resta, Aitken blew a right rear and, fearing delay, headed for the pits at terrific speed. Opposite the judges' stand his car started to skid and rocked from side to side till it slid sideways up the track a distance of 100 ft. past the pit, turning completely around. Aitken threw in low gear and shot up to his pit from the wrong direction. Despite the excitement his pit crew changed the tire with the car facing the wrong way and sent him away in 30 sec. But Resta had taken advantage of his opportunity and was well in the lead, a lead which Aitken could not overcome for long though he forged to the front for a brief interval later in the race, the cars running wheel-to-wheel for the last 50 miles.

Rickenbacher's Maxwell was third, 1 min., 29.15 sec. behind Aitken, although his car was not running very well at the start of the race. Lewis, in a Premier, was fourth, with Henderson's Maxwell, Galvin's Premier, Devore's Duesenberg, Burt's Ogren, Gable's Erbes and Vail's Hudson following him across the tape in the order named. Rawlings in the West Duluth was flagged, covering almost the entire distance on three cylinders. Buzane was also flagged.

All track records were smashed up to the end of the first 40 miles by DePalma, who averaged 105 m.p.h.

The race was between the four favorites, Aitken, Resta, DePalma and Rickenbacher, and DePalma led for 120 miles

The Big Four of the race, Rickenbacher, Resta, DePalma and Aitken

Photo by International Film Service
As the race drew near its close, Resta led with Aitken second and Vail third

in one of the most closely fought contests ever seen on an American speedway until he lost first place to Aitken on account of a tire change and then dropped back to third through two stops caused by a broken valve which was the ultimate cause of his withdrawal.

One Serious Accident

One accident marked the day's event and one which may cause the death of Ralph Hetlich, mechanic for Wilfred D'Alene, driving the Crawford. D'Alene came into the pits at the end of his 15th mile for gasoline and the excited pit man spilled gallons of gasoline onto the track under the car and finally some of it, when the funnel was knocked off, was ignited by the exhaust. The car and the gasoline below it burst into flames which rose to 10 ft. in the air. Hetlich's clothing was splattered with burning gasoline and, temporarily crazed by the pain, he ran up the track toward the judges' stand. Here he was headed off by some of the officials who forced him into the dirt under the judges' stand and wrapped coats about him until the burning clothing could be torn off. He was rushed to the hospital and hope for his recovery is held out, although he is very seriously burned.

Billy Chandler, captain of the Crawford team, also was burned about the hands and throat and the back of the head. It was necessary to force him into the ambulance as, in spite of his injuries, he insisted on endeavoring to help Hetlich.

The fire about the Crawford car was put out in 3 min. by the rapid and efficient work of the J-M fire extinguisher crew which, in spite of the fact that it had to run the entire length of the pits to reach the burning car, subdued the flames before great damage had been done to it.

While the car was still hot and smoking from its inundation in flame, D'Alene again took the wheel with a substitute mechanic and resumed the race. He circled the track once but was forced to come in with the brake bands still burning to change one of the rear wheels whose tire had been damaged by fire; also, to make another attempt to fill the gasoline tank. D'Alene was able to make only four laps more before the scorched car was pushed down the track with a broken driveshaft.

DePalma Takes Lead

The actual start after the preliminary lap was a very pretty one, the line being well kept for the getaway. Aitken led at the end of the second lap but DePalma took the lead at the third lap, having passed Hughes, Resta, Henderson, Wilcox and Aitken in a 2-mile spurt that brought the grandstand spectators to their feet. The order at this time was DePalma, Resta, Aitken and Hughes, with a gap beginning to open up between these four leaders and the rest of the field, all of whom were leaving Gable and Buzane some distance in the rear. At the end of the first 10 miles Gable, whose car was missing badly, was lapped in front of the grandstand. Wilcox and Henderson had crawled up until they were respectively second and third to DePalma, with Aitken, Hugher, Resta and Rickenbacher following in order.

D'Alene again began to show among the leaders and at the end of 14 miles was well up to the front. The speed was too fast for him and he did not maintain his position long. Before 20 miles were gone the speed began to tell on some of the cars and they began to come into the pits, Burt's Ogren being docked temporarily first, and followed shortly by Buzane in the Duesenberg and Vail's Hudson.

The pace was a terrific one, DePalma's time for first 20 miles being 11 min. 34 sec., with Resta, Hughes, Aitken, and Rickenbacher all close at his heels. Resta's time was only 2 seconds slower than DePalma's, while Aitken was running half a length behind. Rickenbacher, D'Alene, Hughes and Burt were all very close up.

During the next 10 miles Aitken and Rickenbacher passed Hughes and the order then was DePalma, Resta, Aitken and Rickenbacher. DePalma was being sorely pushed, the three Peugeots running so close together that there was not a car length between DePalma and Aitken. Rickenbacher was 100 yd. behind. All were traveling at better than 103 miles per hour. Hughes went out with a broken valve spring in the 32nd mile. It was this that caused him to lose his position during the few miles previous. Hughes asked of the car more than it would stand, and while he made a wonderful showing for the first 25 miles the mechanism would not stand the speed he called from it.

A Four-Cornered Race

For the next 70 miles the four-cornered race between the leaders continued, with the speed slowly increasing, and lapping car after car as the three blue Peugeots and the white Maxwell fought for the lead. But DePalma was never headed in the first century. At 40 miles the time was 23:3.65, a speed of 105 miles per hour. At 50 miles it was 29:50 sec., approximately the same speed.

After the accident to D'Alene's car the speed dropped somewhat for a time but again picked up. At 70 and 80 miles the speed had dropped to 102 miles per hour. Rickenbacher was the first of the quartette to show the effect of the terrific speed, having to come into the pits at about 76 miles for a right rear tire. His pit work was very fast and his time lost slight, not enough to cause him to lose his fourth position. At 80 miles the order of the first ten was as follows: DePalma, Resta, Aitken, Rickenbacher, Wilcox, Devore, Milton, Henderson, Klein and Lewis. DePalma's time for this distance was 45:25, a speed of little better than 102 m. p. h. At 90 miles the order was practically the same throughout, and the speed increased slightly to 102.5 miles per hour. DePalma was still leading at the 100-mile point and his time was 56:58.41, a speed of 105.2 m. p. h. DePalma came in shortly after this, making his first stop and changing a right rear tire. This caused him to drop back into third place, as Resta and Aitken both passed him.

Rickenbacher was improving his opportunity to make up time lost by his stop and still further increased his speed,

when he saw DePalma at the pit, making laps at 106 m. p. h. as he forced his car to its utmost.

Resta Sets the Pace

With DePalma temporarily out of the lead, Resta set the pace with Aitken close at his heels, so that at the 120-mile mark Resta was leading, Aitken second and DePalma third, with Rickenbacher a bad fourth. The time at this point was 1:08.22, a speed of 105 m. p. h.

The terrific pace brought Resta in to the pits on the next lap for supplies, taking on gas and changing a right rear tire. The pit work was very fast, Resta being held only 28 sec.

Aitken had not stopped as yet and the two halts by the leaders put him in the front. This he held for the next 70 miles. Resta's stop let DePalma overtake him so that the Italian was pushing Aitken for first with Resta and Rickenbacher following. From the 140-mile point until after approximately 190 miles had been covered he came in with his engine missing badly, and after a lap or two withdrew with a broken valve.

Aitken's Narrow Escape

Almost at the same time Aitken very nearly ended his chances for finishing the race when, in coming in with a flat tire for his first stop at the pits, he skidded badly, turning completely around, but by masterly handling kept the car on its four wheels and pulled up at the pits, facing in directly the wrong direction. He was away in 30 sec., but meanwhile Resta had passed him, taking the lead. The old National driver gave the car all it would take when he took up the chase of the Italian and turned several laps in 1:05, a speed of better than 109 m. p. h. At 200 miles Resta was leading, Aitken second, Rickenbacher third, and Wilcox fourth. Resta made the distance in 2:07.01, with Aitken only 2 sec. behind. Rickenbacher was a minute behind the leader and Wilcox was over 2 min. behind having been lapped by Resta and Aitken. Their speed at this point was close to 105 m. p. h.

Resta and Aitken ran neck-and-neck for the 50 miles remaining but Resta was always a nose ahead of the Indianapolis driver, except for one short space, when Aitken succeeded in crowding ahead temporarily. Resta undeniably could have made more speed at this time had it been necessary for him to call upon his car for it.

Slipping Clutches Give Trouble

THE race developed a new ailment. Slipping clutches have seldom held such an important part in speedway races. Ostewig, in the car bearing his name, was in the pits four times, consuming in the neighborhood of 20 min., dosing his clutch with dirt, sand, and finally inserting hack-saw blades to lock it in place. Milton went out entirely with a shredded-clutch facing and it was the claim that Johnny Aitken's speed was reduced throughout the contest by a clutch that persisted in increasing the ratio between the engine and the rear wheels.

There were thirty-nine stops in all, and only eleven of these were for tires. The other twenty-eight went to patch up mechanical difficulties.

As a matter of habit, Resta's one pit stop was made in record time for the meet. He changed a right rear and took on gasoline in 28 sec. This however was a plain slide-in-and-roll-out-again stop, and not as costly or exciting as Aitken's only pit visit, already described, the Hoosier pilot nearly coming to grief as he tried to shoot into his pit at high speed for a new tire. This stop cost him first place.

The Crawford pit, with one of its cars bearing No. 13, suffered about as disheartening a climax as ever occurred in a Speedway race. After D'Alene took his fire-blackened car back into the race with a new mechanic substituted for the one who was nearly cremated and drove a few more laps a connecting-rod let loose and he was out for good.

On the same lap, Klein's Crawford split a crankshaft and the havoc it wrought in the motor is probably beyond repair. The whole crankcase assembly was literally torn to fragments.

The fire in Devore's Duesenberg can also be attributed to carelessness. He stopped for a tire and the motor did too. The mechanic tried to crank the motor again, and as it would not start he opened the hood and attempted to tickle the carbureter. Instead, he knocked off the cap of the float chamber, the float shot out and the explosive fluid poured itself generously over the car and track. When the motor was cranked, the gasoline-loaded cylinders backfired through the carbureter and started the fireworks. Fortunately it all took place directly in front of the J-M extinguisher pit and these overworked fire-fighters made quick work of it.

Ralph DePalma went out with a broken valve. This Peugeot has been a particular offender in valve trouble, Mulford having run up against the same thing when he drove the car. It is getting to be a conventional statement that Ralph goes out with some part of his motor broken and many race fans have ventured to ask "Where is the DePalma of a year ago?" The veteran driver once carried the reputation of humoring his car in the early part of a race and leaving his spurt for the last. His tactics throughout the 1916 season have been just the reverse, and there does not seem to be a car built that will stand his Burman-like driving.

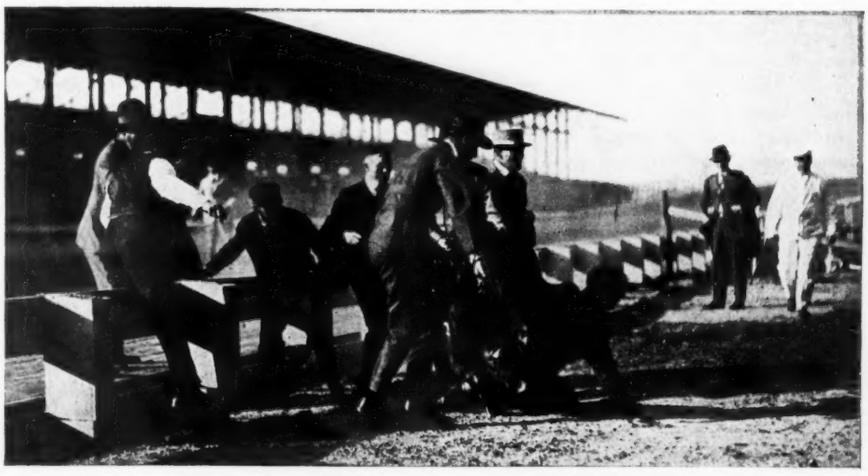
Other Mechanical Troubles

Again Buzane's Duesenberg sprung a leak in the water pump. This car has this particular trouble as regularly as the starting flag is waved. In to-day's race it was even worse than ever and the water which spurted from the leaky pump packing found its way into the carbureter and caused four pit stops.

Wilcox, another of the Peugeotic contenders, experienced a typical DePalma last hour demise when he rolled into the pits with one lap to go with a broken rod. He was then running in fourth place which made the faulty connecting-rod an expensive investment.

Ira Vail, who drove his battery-ignited, starter-equipped

(*Continued on page* 673)



Hetlich, D'Alene's mechanic, in flames on the track

Value of Rating Formula Limited

Can Never Involve Any but Qualities Capable of Mathematical Measurement—May Be Useful to Engineers and a Few Car Buyers—Detroit S. A. E. Discusses Fishleigh's* Paper

By J. Edward Schipper

DETROIT, MICH., Oct. 14—The Detroit section of the S. A. E. is agreed that it is impossible to measure all that is meant by the term "Car Performance" in a single formula. This is perhaps not a new idea, but it was certainly crystalized in the discussion following the reading of Professor Walter T. Fishleigh's paper on Automobile Performance and Methods of Comparison at the monthly meeting of the section last night.

Everyone present agreed that it is possible to get a formula that will act as a very satisfactory basis of comparison. The mathematical factors of comparison—speed range, accelerative ability and fuel economy—are basic and can be so treated, but all other things, such as comfort, either mental or physical, ease of control, etc., cannot be embraced by a mathematical expression.

Eliminating the important comfort factor of course removes a large part of the value of a rating factor as far as the average individual that buys a car is concerned, but it in no wise affects a great many points of value which such a formula may have for the engineer or even a car-educated buyer who carries his investigations further than what he would secure from a demonstration. The mathematical factors which remained unscathed by the discussion and which would be above criticism in the rating or performance comparison were those of speed range, accelerative ability and fuel economy.

Whether or not these should be all combined into one figure was a matter considerably open to debate, as it was pointed out that by combining them the relative value of each term was forgotten and therefore they should be allowed to stand in their original form so that a man who was buying a car by this rating method would be able to give greatest weight to either speed range, acceleration or economy. The three factors were called in Professor Fishleigh's paper, *S*, *A* and *E* respectively, being also the initials of the Society.

Professor Fishleigh is a member of the standards committee of the S. A. E., and since one of the divisions of the committee to which he is attached has in hand the matter of determining a standard S. A. E. rating formula, the paper and its discussion take on considerable significance. The question seems to have two sides: first, what is the rating formula for; and second, the determination of the formula.

Last night's meeting seemed to settle the first point very satisfactorily, and summed up in a nutshell it may be stated that the rating formula is for the purpose of comparing the combined factors of performance which are capable of mathematical measurement.

The second part of the question was not so clearly solved, as there was no general agreement on all the factors that should be involved in the final result. The latter difficulty, though, is certainly more easily overcome than the first seemed to be, and a number of formulæ that were satisfactory to 500 members in attendance were offered, particularly by C. T. Myers of the Timken Co., C. C. Hinkley, chief engineer of the Chalmers company, and K. W. Zimmerschied, engineer of the General Motors Co.

Automobile Performance and Methods of Comparison

By Walter T. Fishleigh*

IN general, factors which make for good car performance have come to be more or less agreed upon. In general, the tests which show the degree of car performance or car ability are pretty well recognized, and there is little doubt that if a new model were to be handed over to any committee of three selected from this meeting to-night with instructions to try it out for general performance, approximately the following tests or their equivalent would be made.

1. The car would be driven upon good pavement to determine its range of operating speed, that is the lowest and highest speed at which and between which the engine and car operate steadily and successfully.

2. The acceleration would be tried out, probably starting at the lowest steady operating speed and determining the time necessary to accelerate to its maximum speed, or perhaps the test would be run between two arbitrarily set limits, as from 5 to 55 m.p.h.

3. The car would be tried out on steep grades or hills. This test would involve both high gear work at different speeds, and operation in the gears.

4. Tests would be made upon the road or upon a speedway to determine fuel economy; that is, miles per gallon of gasoline. Economy runs have often been made and advertised as under "average touring conditions," but upon consideration it will be manifest that economy runs, to be scientific, definite and comparable, should be run at a number of definite speeds, as for example, 10, 15, 20, 25, 30, 40, 50 m.p.h. The results will give an economy curve, which tells the complete story of economy at various speeds. An average fuel economy may be found from this curve, but the detail curve itself is not only desirable but necessary.

5. The car would be run over good, bad and indifferent roads, at various speeds, and going through various maneuvers, for the determination of riding comfort. This factor is the resultant of many items in design, such as weight, wheel base, spring suspension, engine characteristics, body and seat design, etc. If carried to the theoretical limit, it is an exponential function also of the way an engine pumps

*Professor Automobile Engineering, University of Michigan.

oil and soots the spark plugs, the kind of gear shift employed, the number of punctures per tire per mile, and the percentage rise in small-town hotel prices when the driver pulls up with a particular make of car and applies for accommodations. These latter, though important, may be neglected in the present discussion.

Summing up the above, we may assume that for completely trying out car performance, tests would be run for the determination of (1) range of operating speed, (2) acceleration, (3) hill climbing ability, (4) fuel economy in miles per gallon, (5) riding comfort. It is proposed that acceleration tests be agreed upon as the standard factor in car performance for indicating excess draw-bar pull. Complete performance then becomes the resultant of the following four factors:

1. Speed range
2. Acceleration
3. Economy of fuel
4. Riding comfort

The application of each of these factors needs hardly to be argued; whether there should be more or fewer of them is open to argument.

Expressing our discussion mathematically, we may write:

Automobile performance varies directly as speed range, acceleration, economy of fuel and riding comfort.

$$\text{Automobile performance} \propto S.A.E.C.$$

Where S = speed range in high gear, in miles per hour
A = average acceleration of car in feet per second per second over the complete range of its operating speeds.
E = average fuel economy, over the complete range of its operating speeds, in miles per gallon.
C = riding comfort factor, which must be determined by each individual judge.

It is manifest that complete car performance or car ability, on account of the item C, cannot well be determined once for all by rigid tests, nor estimated in any simple and practical way. The one item C must be left to personal judgment, if not to personal eccentricity. In considering car performance, however, the other items ($S.\ A.\ E.$) are each susceptible of scientific determination and measurement, and their combination when obtained, while not giving the complete expression and answer for car performance, still affords a valuable comparison for cars and constitutes what might well be called the Automobile Performance Factor.

$$\text{Automobile Performance Factor} = S.A.E.$$

When considered from the standpoint of this three-fold "Automobile Performance Factor," different cars can be definitely tested, a definite value for each item in the factor obtained, and relative performance quantitatively rated as regards speed range, acceleration and economy of fuel. For the engineer, the manufacturer and the buying public this factor affords a ready and reliable means of comparison of car performance, and an investigation of the three items, which go to make up the complete factor, leads at once to comparative values in the details of performance. Illustrating the application of this automobile performance factor, suppose we have two cars; the first with speed range 10 to 50 m.p.h., acceleration from 10 to 50 m.p.h. in 30 sec., average miles per gallon 20; the second with speed range 5 to 65 m.p.h., accelerating from 5 to 65 m.p.h. in 20 sec., average miles per gallon 10.

$$\text{Automobile Performance Factor} = S.A.E.$$
$$\text{For first car} = 40 \times 20 \times 2 \quad (=1600)$$
$$\text{For second car} = 60 \times 10 \times 4.4 \ (=2640)$$

The value of this factor, or more properly the value of the three items in the factor, coupled with a consideration of item C (riding comfort), leads to accurate estimate of complete car performance or car ability and should form a sound basis upon which to judge the car as an operating unit. Indeed, we may individually go even further, assign a relative percentage value to the comfort factor C, multiply our car performance factor by it, and obtain at once a figure for each car which represents complete car performance or car ability. Some question may rightly be raised as to the relative weight which should be given each of the items S, A and E in the factor, but after extended consideration, it would seem that from the standpoint of importance to the operator, no better than equal weights can be assigned. In this factor, the item "car weight" does not appear separately, but indirectly exerts its influence upon S, A and E. In each case the penalty for increased weight appears in a reduction of the value of acceleration, mileage per gallon of fuel and speed range, the effect upon the final automobile performance factor being marked. It must be clearly emphasized that the items in the performance factor have reference solely to performance of the car as it stands, as an operating unit. The relative advantages of the seven seats of the touring car as compared with three in the roadster, the riding qualities of the heavy car as compared with the light car, the operation of the twin-six engine, as compared to the four or six or eight of equal horsepower, the advantges of the limousine body as compared to the touring car—all these are matters to be settled in a preliminary consideration or to be included with proper weight in the riding comfort, item C. The factor is of particular value in comparing the relative performance of two cars of generally similar characteristics. Nor is it desirable to compare, from the standpoint of performance, widely different structures such as the pleasure car and the truck, vehicles designed for entirely different service, in which the various items which go to make up car performance have entirely different relative values. Indeed, the performance factor for the commercial truck may be quite different and a subject for separate consideration.

A simple and thoroughly accurate acceleration test has been proposed as follows: The car is brought to its lowest successful operating speed and driven at that speed to the starting line of a measured course, where it is accelerated as rapidly as possible to its maximum speed over this course. Measured intervals are laid off along the course, and at each interval a contact point is located which is operated by a small gate carried under the front axle. At the starting line is located a recording drum, revolved by clock mechanism or by electric motor driven by batteries. Writing its record upon this drum is a small marker, which is electrically operated by a calibrated clock and which registers time elapsed in seconds or half seconds. Another marker is electrically operated by each of the various contact points along the course. Thus is obtained an accurate record of the time for traversing each of the measured intervals along the course. From this data, an accurate determination of accelerations at the different speeds can be had, either by means of curve plotting or by calculation. The final acceleration curve will show accelerations in feet per second per second of the car at each speed of its range.

Fig. 1 shows an acceleration curve from a six-cylinder car, total weight 5280 lb., gear ratio 3 10/13 to 1, size of engine 4½ by 5½ in., wheel diameter 37 in. Fig. 2 shows an acceleration curve from an eight-cylinder car, estimated gross weight 4150 lb., gear ratio 5 1/14 to 1, size of engine 3⅛ by 5⅛ in., wheel diameter 36 in.

Typical curves for fuel economy runs at various speeds are shown in Figs. 3 and 4. The curve in Fig. 3 was obtained from tests upon an eight-cylinder car, 3⅛ by 5⅛-in. bore and stroke, gear ratio 4.5 to 1, tires 36 by 4½ in., estimated gross weight 4150 lb. The curve shown in Fig. 4 was obtained from a four-cylinder car, 3⅝ by 4½-in. bore and stroke, gear ratio 3.58 to 1, tires 30 by 3½ in, estimated gross weight 3000 lb.

Other Ability Formulæ

Many formulæ for automobile performance or car ability have been developed. They differ widely in method of ap-

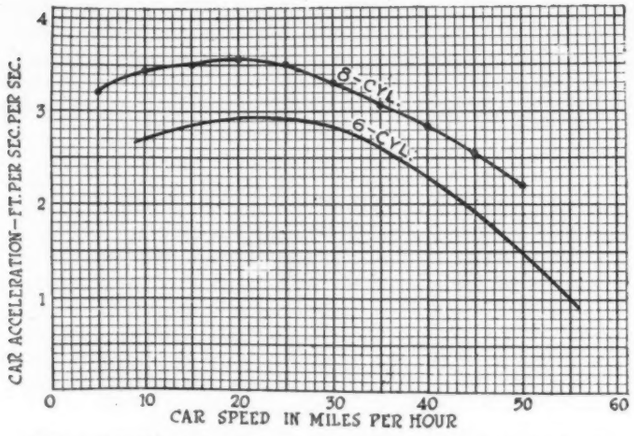


Fig. 1—Acceleration curve for six-cylinder car. Fig. 2—Acceleration curve for eight-cylinder car

proaching the question of performance; they differ in the fundamental factors included; in the majority of cases they are efficiency formulæ strictly, developed for estimating, from engine size, gear ratio, weight, wheel size, etc., what the probable performance or probable performance factors of a car will be; in no cases are they as comprehensive as, in the opinion of the author, they should be to cover the ground of performance; in no case are they based entirely upon accurate, scientific tests which determine at once beyond doubt the true values for the factors which make up performance and, therefore, the true value for performance itself. A consideration of the most important of these formulæ will be of value.

(Symbols used in formulæ):

d = diameter of cylinders in inches
s = stroke in inches
n = number of cylinders
r = gear ratio
D = diameter of wheels in inches
W = gross weight of vehicle in pounds
M = average fuel economy, in miles per gallon
P = horsepower of engine, at a given speed.

1. Ability $= \dfrac{P r}{W D}$.

This simple formula is one of the oldest and perhaps most widely known for estimating so-called ability. Its mathematical value has a direct physical interpretation, in that at a given speed for cars of equal transmission and rear axle efficiencies, it will be proportional to total draw-bar pull per pound of weight. For cars of different transmission and rear axle efficiencies, the formula becomes more or less inaccurate. Acceleration or hill climbing ability of a certain car at a given speed, however, is proportional to excess draw-bar pull per pound of weight over that necessary to propel the car at the given speed as discussed above, so that even as an estimate of this one factor in automobile performance, this formula is hardly tenable. For two very different cars, such for example as a limousine and a speedster, the total draw-bar pull per pound of weight may be the same, yet the excess drawbar pull per pound of weight (and, therefore acceleration and hill climbing ability) be quite different, especially at comparatively high speeds. The use of this formula as is customary, by the mere substitution of maximum engine brake horsepower for P when two cars are being compared, is of little, if any, value. If maximum torque were used, instead, we should come nearer relative hill climbing and acceleration abilities, but even then the results would not be directly comparable. As a formula for estimating complete automobile performance or ability, it does not include the three factors, speed range, fuel economy and riding comfort. As a formula for use as an automobile performance factor it does not include speed range or fuel economy, and is not strictly correct for acceleration or hill climbing ability.

2. Vehicle Coefficient $= \dfrac{8 n d^2 s r}{D W}$ —(Myers, 1915).

3. $K = 14550 \dfrac{d^2 s n r}{D W}$ —(Roebuck, 1912).

4. $Q = 3000 \dfrac{d^2 s n r}{D W}$ —(Thomas).

The close similarity of the above three formulæ will be manifest and they may be considered together. Mr. John Younger has pointed out that "these three formulæ represent piston displacement per pound moved 1 ft., and on the reasonable assumption that every cubic inch of piston displacement represents so many foot pounds of energy, these formulæ give a measure of a car's ability. The greater the displacement per pound moved 1 ft., the greater should be the car's ability to speed, to climb and to accelerate on the particular gear reduction considered." From another viewpoint each of these three formulæ represents total drawbar pull per pound of weight. These formulæ like No. 1 may be of value in estimating total draw-bar pull for cars of the same transmission and rear axle efficiencies, providing their engine efficiencies are equal. Considered as formulæ for approximating acceleration or hill climbing ability, practically the same difficulties appear in the use of these formulæ as in the use of No. 1. The constants in these formulæ are the result of a number of assumptions, which in widely different cars do not hold. The constant 8 in formula No. 2, for example, is based upon the assumption that "all motors will develop a torque in pounds at 1 in. radius equivalent to that of their N. A. C. C. horsepower rating," and that the product of engine efficiency by transmission efficiency "for the average well built car will be about 95 per cent." Even aside from these assumptions, these formulæ give us merely an approximate estimate for total draw-bar pull per pound of weight. In no way are speed range, fuel economy or riding comfort taken into account.

5. $\lessgtr = \dfrac{1}{10} \dfrac{d^2 s n r M}{D}$ —(Thomas, 1913).

The above so-called "Sigma Formula" differs from the other formulæ considered in that the factor M (average gasoline consumption in miles per gallon) is included. This M is determined by complete tests and is evidently a proper and reliable factor in performance. The remainder of the formula considered alone ($\dfrac{d^2 s n r}{D}$) represents piston displacement per foot the entire car is moved, or from another viewpoint it represents total approximate draw-bar pull. In nowise, is acceleration or hill climbing ability proportional to total draw-bar pull, regardless of weight and the draw-bar pull necessary to propel the car at any given speed. The difficulties encountered with this part of this formula are, therefore, as serious as those for formula No. 1, only more so. Only where cars have the same engine, transmission and rear axle efficiencies, will a formula based upon motor dimensions, gear ratio and wheel diameter give a reliable approximation for total draw-bar pull, and this total draw-bar pull is not, in general, a measure of the acceleration or hill climbing abilities of these cars. In this formula, no account is taken of speed range. The curve obtained, however, by plotting values of Sigma for a car at various speeds as shown in Fig. 5, is extremely interesting. This curve was obtained from comprehensive tests upon a six-cylinder car, bore and stroke

5 by 7 in., gear ratio 2.88 to 1, wheel diameter 38 in., estimated total weight 5900 lb.

6. Ability $= \frac{D}{W}$ —(Brush, 1916).

Where D = excess drawbar pull at any speed over that necessary to propel the vehicle at that speed.

This formula, which may be interpreted as representing excess draw-bar pull per pound of weight, gives an accurate measure of hill-climbing ability, an approximate measure of acceleration. It has been proposed that this excess draw-bar pull D at any speed be determined directly by test upon a level course or speedway by attaching a special dynamometer car or attachment to the rear of the car under test and by means of brakes on the special car, control the speeds. If such special car and dynamometer can be devised, and if the dynamometer under the conditions of high speed incident to such tests were to give substantially steady readings which could be relied upon, this method would be direct and acceptable for the determination of that one item, excess draw-bar pull, which in automobile performance is evidenced by hill-climbing ability or acceleration or both. As a complete automobile performance or ability factor, this formula takes no account of fuel economy or of speed range. It is suggested that this $\frac{D}{W}$ value be multiplied by E and then by S, for the complete factor. On the assumption that the proposed tests for $\frac{D}{W}$ values can be successfully carried out, the proposed factor would seem to be satisfactory.

Discussion Full of Suggestions

C. T. Myers, engineer of the Timken company, presided and opened the discussion. He said that Prof. Fishleigh's factor C (comfort) is not susceptible to accurate determination, although the other factors are and the author has accurately analyzed them. There is no attempt to measure the efficiency, but only to indicate it: "A point which will surely be argued," Mr. Myers said, "is the speed range. Another way of looking at this is to use it in a way that will accentuate its effect on the formula by taking the ratio of the highest speed to the lowest. That is instead of subtracting the lower from the highest speed, the highest speed may be divided by the lower."

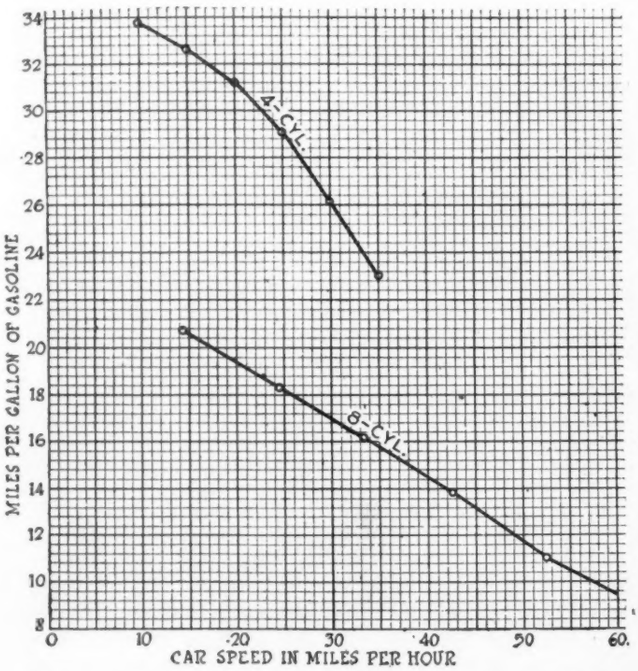


Fig. 3—Fuel economy curve for eight-cylinder car. Fig. 4—Fuel economy curve for four-cylinder car

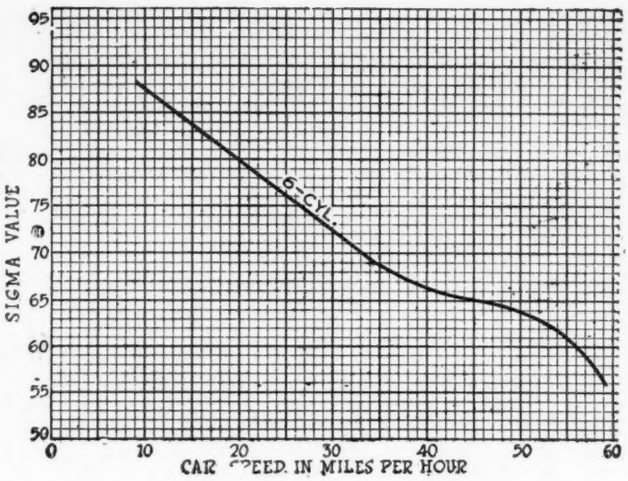


Fig. 5—Sigma values for six-cylinder car sigma formula is $\Sigma = \frac{d^2 s n r M}{10 D}$ in which M is average fuel economy and the remainder of the formula represents displacement per foot of travel

K. W. Zimmerschied, metallurgist of the General Motors Corp., stated that he did not see the necessity for carrying out the multiplication of the factors, as the product does not tell anything. In other words, a man may have an entirely different car and get a product of 2520 in one case and 2500 in another. This is only a small difference in the products, while the cars may be widely different. The real purpose is simply to enumerate the qualities and therefore the product is of no use.

A. P. Brush, consulting motor engineer, said that owing to the efforts of the standards committee to determine a formula, it is necessary that great care be taken in the recommendations. He stated that there are a great many objections to the expression as it stands, i.e., $F = S.A.E.$ "Take miles per gallon," he said. "Is it a factor of performance? It is rather an item in the cost of performance and should be figured with such things as first cost of the car, tire cost and general maintenance expense. Let us also take the speed range factor. According to this method of rating a car that has a range of from 44 to 100 miles an hour on high gear, will be just as satisfactory as one that has a range of from 4 to 60 miles an hour. The object of the high speed engine is to give the user the benefit of low speed performance, and this is important to the average user most of the time.

"The $\frac{D}{W}$ (D is excess draw-bar pull at each speed, W, weight) formula is worthy of consideration, as this makes possible the consideration of the speed range as well as the economy.

"Another point that should be settled is what is meant by the lower end of the speed range. You must call the lower end of the speed range that at which the engine will perform smoothly at wide open throttle. The $\frac{D}{W}$ formula is a direct expression of the sine value of the hill that the car can climb."

(*Continued on page* 667)

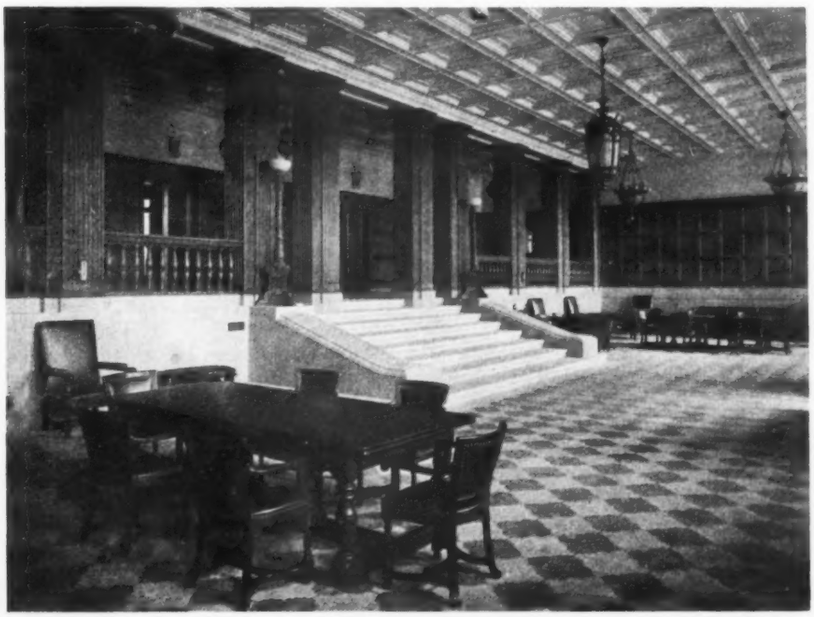
Willys-Overland's New Headquarters

Administration Building Is One of the Finest Identified with the Industry—Seven Stories—Is 375 By 60 Ft.—Houses Working Force of 950—Economy a Feature of Design

Front of the new administration building just occupied by the Willys-Overland Co., Toledo, Ohio. The building is of steel construction with an equitable brick exterior. There are four passenger elevators and one for freight

TOLEDO, OHIO, Oct. 14—The Willys-Overland Co. has just located in its new administration building, which is one of the finest office buildings connected with the automobile industry. It is a seven-story, brick structure, 375 by 60 ft. and houses a working force of 950 people. All of the administrative offices in connection with the factory are located in the building, which is an architectural model to the industry and well adapted for the work. On entering the building the atmosphere is more that of a huge hotel than an executive building for an automobile concern. On the ground floor is a reception room 100 by 30 ft. resembling the corridor of a large hotel. It is filled with large couches, divans, chairs, etc., and fronting on one side of it are the elevators. The building is served by a system of four Otis passenger elevators, each with a capacity of twenty people, in addition to which is a 5000-lb. freight elevator.

The building is of steel construction with an equitable brick exterior giving a most attractive appearance. It is located directly across the factory from the old offices and fronts on the city boulevard and faces what is known as the Model 75 building, that is, the huge assembly building, 1000 ft. in length, in which the Model 75 is built.



General reception room, more sumptuous than the lobby of many hotels

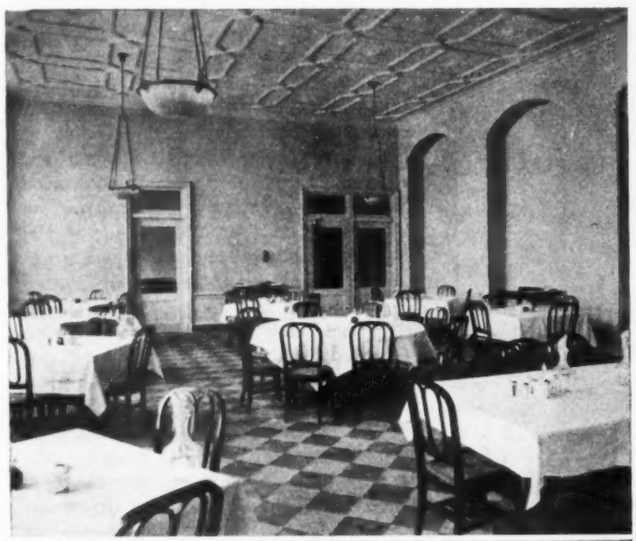
The general layout of the administration building has been worked out with economy in every feature as a foremost requisite. Those departments such as Purchasing, Service, and Traffic are on the main floor, so that the elevator service will not be called upon to serve those departments. These are the departments that have most business visits from outsiders per day.

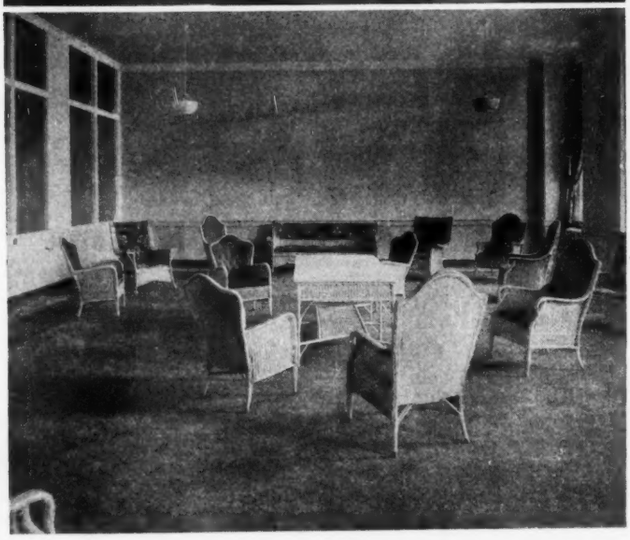
The second floor is given over entirely to accounting and a novelty is the use of steel furniture throughout. Each clerk sits at a steel table and back of it is a steel cabinet, little higher than the table, in which all of the books, etc., are kept.

The third floor may be described as the middle floor of the building; there are three below it, counting the basement, which is a level ground floor, and three above it. On this middle or central floor are all the central correspondence files for the entire building; the force of forty or more stenographers occupies a department of this floor;

(*Continued on page* 663)

At the left is the private office of President John N. Willys in the new administration building, at the Toledo factory. At the right is the directors' room, where the weighty problems of the big Willys-Overland organization will be threshed out. The conventional heavy table extends the length of the room, giving it an air of dignified importance typical of the accomplishments of the company





Above at the left is one of the private dining rooms for officers and other executives of the company. At the upper right is a glimpse of the accounting department, showing the steel equipment and filing devices. Below at the left is the general dining room or cafeteria accommodating over 600 at one time. Below at the right is the girls' rest room with its white ivory wicker furniture

Automobile Conditions in Europe

Importations to British Isles and Italy Forbidden—70% Duty Into France—Tires Scarce in Neutral Countries—Better U. S. A. Service Needed on Electric Starters and Generators—More Attention Needed in Export Trade

By Peter Steenstrup

Editor's Note:—Peter Steenstrup, representative of the Hupp Motor Car Co. in Europe and Latin-America, has recently returned from a 5-months trip through ten countries in Europe, visiting most of the continent excepting Russia, the Central Powers and Holland. In this article Mr. Steenstrup tells of automobile conditions as he found them.

NEW YORK CITY, Oct. 13—With all the countries in Europe which are not at war, business is generally in excellent shape, and several neutral countries are literally rolling in wealth. With this condition it is not surprising that there is an unprecedented demand for automobiles, and accessories. In filling this demand the U. S. A. is the greatest possible source of supply because scarcely one of the neutral countries can be classed as a manufacturing country. Spain has one or two factories and there are one or two in the Scandinavian countries.

With such a favorable market it is no credit to U. S. A. manufacturers that we are getting the business because there is no other place to buy cars. We are to-day selling our cars cash against document in New York. Generally European dealers are disappointed that our manufacturers have not made active steps toward establishing a more liberal basis of doing business with European neutrals. It would be to our credit to offer more favorable terms of payment now when we are not compelled because of international rivalry to do so. When the war is over international rivalry will require us to give better credit terms, perhaps 90 days. European dealers will then not thank us for giving credit extension because they will realize we will have to do it.

It is further expected by European dealers that we will lay more constructive plans for giving better service throughout Europe. With our highly-developed automobiles using essentially U. S. A. electric starting and lighting systems, a much better service is required. To date our parts manufacturers have done very little to establish that service which is necessary in Europe for their electrical systems. This applies to ignition systems, batteries, starters, generators and horns.

PETER STEENSTRUP
Hupmobile Representative for Europe and Latin-America

This lack of service is bound to react on us as soon as European manufacturers are back in the field. To-day is the time when we should prepare to meet the post-war competition, rather than waiting until terms of peace have been signed.

The question of getting pneumatic tires from neutral countries is one of the greatest obstacles in European car business at present. Norway and Sweden are particularly hampered in this respect to-day. This is due to the fact that during 1915 there was a great deal of smuggling of tires from Sweden to Germany, and now Great Britain, which holds the key to the tire situation for Europe, is getting even and will not ship tires or permit them to be shipped to Sweden. You can ship as many cars without tires as necessary. There is no prohibition of cars, but tires are under the ban. When tires are received they reach these countries in small instalments. In August no licenses for shipping tires into Sweden had been granted for several months.

To-day in Sweden it costs the price of a Ford car in the U. S. A. to buy a set of tires. I saw a dealer in Stockholm on Aug. 10 pay $167 U. S. gold for a 34 by 4 casing. I saw $12 paid for an old 34 by 4 inner tube, with fourteen patches. In addition to tires being very expensive, gasoline is retailing at from 50 to 75 cents per gallon.

There is a possibility that Jan. 1, 1917, may bring some relief in the tire situation with these countries. On that date Great Britain's conventions or arrangements with neutral countries, with regard to automobile tires, expires. It is rumored on good authority that Great Britain by that time will be willing to permit shipments of cars with tires into many neutral countries. If such is permitted it will greatly increase the sale of U. S. A. cars in Scandinavian countries.

The sale of U. S. A. cars in England, France and Italy is practically suspended, except to the governments. The sale of cars in England and Italy, except to the government, is forbidden. You can still sell in France by paying a 70 per cent import duty which is practically equivalent to an embargo.

Among the neutral countries, Switzerland would gladly buy cars but is practically prevented from doing so by the British blockade. Very few outside cars get into the country. What cars Switzerland is building to-day are largely being required by the government.

Business Booms in Spain

Spain is one of the neutral countries where the automobile business is thriving. The country is profiting because of the war and the government is aware of the fact that automobiles and motor trucks are as essential in war as guns and ammunition. The sale of cars in Spain is generally handled from Madrid. Outside of the capital Barcelona is the leading city, and is the greatest manufacturing center in Spain, being known as the Manchester of that country. In the Barcelona zone are more industries than any other part of the country. The city has a population of 560,000 and the streets are well paved.

In Barcelona is the factory of the Spanish automobile company where the Hispano-Suiza car is made. King Alfonso is one of the large stockholders in this concern and the output is largely absorbed by the government. The factory is producing several hundred cars per month, all being four-cylinder models.

Spanish Roads Poor

Spanish roads are generally not good. In the northern country in the summer resort district of San Sebastian are good macadam roads. Outside of large cities macadam roads radiate for upward of 50 miles. Once beyond this zone roads are sandy and rocky. To-day touring in Spain is looked upon as a stunt rather than a pleasure.

U. S. A. cars are selling in good quantities in Spain to-day. Fully 75 per cent of our cars are sold in cities. This is largely due to the fact that city people have profited most by the war. Spain in general wants five-passenger cars. Throughout the country are many body-builders who build closed types as needed. Gasoline is selling at from 50 to 60 cents.

Of neutral countries, perhaps Denmark has profited as much by the war as any other country. It is reported she has made enough to pay off her entire national debt. I was not able to visit Holland, for when I got to England for the second time after traveling through several continental countries, the English government decided I had traveled and seen enough, and would not let me into Holland. I was permitted to go to Norway, Sweden and Denmark, but my passport was stamped "No return to England," so I had to return direct to America from the Scandinavian countries.

The Scandinavian countries, that is Norway and Sweden, including Denmark, have made their money out of various products that have been sold to Allies and Teutons. They let Germany bid against England, and sell to the highest bidder. Some of the products most in demand are foods, fish, minerals and lumber.

Before placing an absolute embargo on the importation of automobiles, England was doing all she could to discourage the use of motor cars for pleasure. Among the emphatic means employed by the British Government in this regard may be mentioned, thousands of huge posters plastered all over London accusing people who used automobiles for pleasure of being "Germans."

Norway a Growing Market

Great Britain is making the best possible use of her sea power to control the movement of all sorts of supplies which might ultimately reach her enemies. Before our automobile exporters complain of Great Britain's efforts to regulate the movement of tires they probably do not know to what extent nearly every line of trade of the small neutral countries are regulated. Norway was prevented for a long time from importing cotton and could obtain it only by agreeing that it would not be used for making fish yarns. In that way Great Britain could regulate the catch of fish and thus indirectly at least prevent this class of foodstuffs reaching Germany in too great quantities. Fish bring high prices in Germany and the unlimited catch and sale of same to Germany would make many more small fortunes in Norway and consequent increased sales of automobiles.

Willys-Overland's New Headquarters

(*Continued from page* 660)

the women's rest room, with a graduate nurse attendant is located here; and other hospital arrangements are on this floor. It is the most convenient, being half way up and down, for the stenographic force which goes up or down to the different offices as required, also for filing, etc.

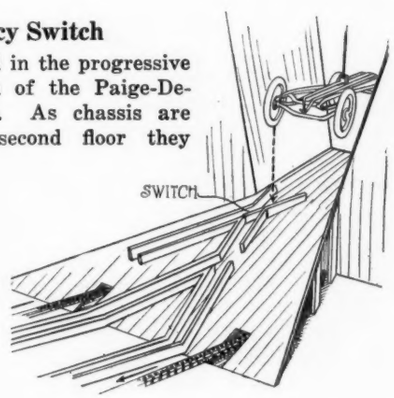
Fourth floor, that is first above the central one, is given over entirely to sales departments, including separate offices for all the departments of sales.

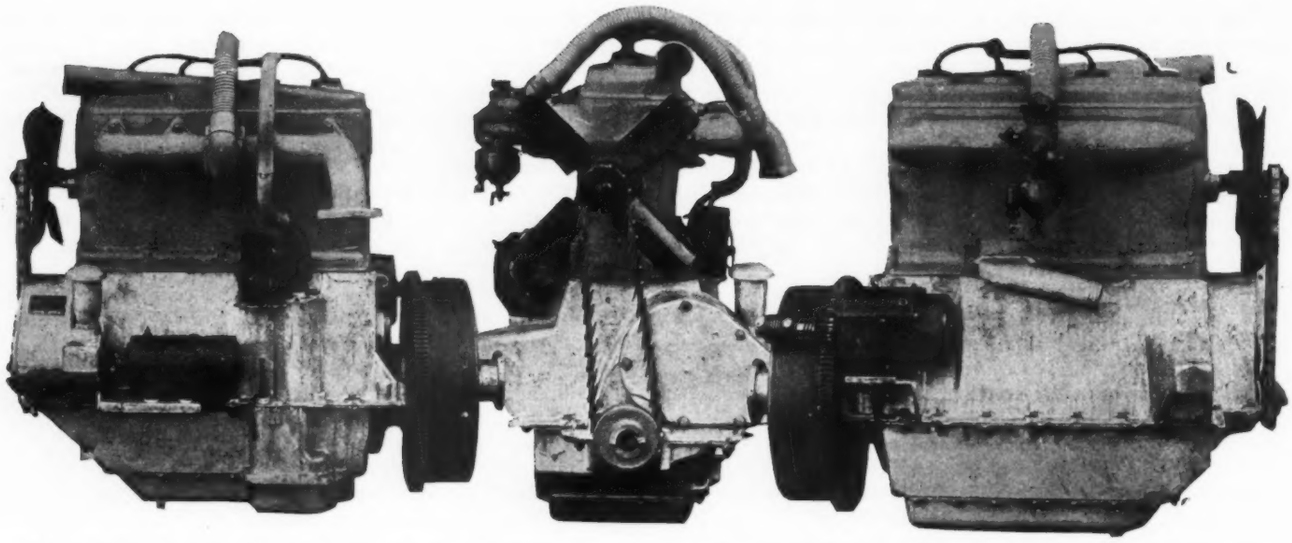
Fifth floor is devoted exclusively to offices of the executives of the firm and board rooms. On this floor the office of President John N. Willys is finished in walnut, and is a model of its kind. The board room, similarly finished, has panelled walnut walls, and the customary ponderous table extending from end to end which carries the atmosphere of a bank board room. All of the vice-presidents and other officers have offices on this floor.

The sixth, or top floor, is a huge cafeteria, with capacity for 200 persons every 30 min. This cafeteria occupies but one-half the floor, the other half being a large auditorium with seating capacity for 600, a stage at one end for moving picture programs, and a dancing floor. The cafeteria has been carefully worked out so as to give efficiency. The luncheon hour ranges from 11:30 to 2 o'clock. It is handled in 30 min. relays. One division of the office takes luncheon 11:30 to 12:30; another 12 to 1; another 12:30 to 1:30; and the fourth 1 to 2. Luncheon prices are very low. The prices are: Meat orders 9 cents; soups 5 cents; vegetables 4 cents; dessert 5 cents; coffee, milk or tea 3 cents. Coupon books worth $2 are used in payment.

An Efficiency Switch

THIS switch is used in the progressive assembly system of the Paige-Detroit Motor Car Co. As chassis are lowered from the second floor they are switched to the right or left track as required. There are two tracks on the lower floor and the switch enables the chassis to be evenly distributed.





Moline-Knight engine, showing mounting of 6-volt Wagner generator with grounded return, which replaces a 12-volt two-wire type. Also Connecticut ignition distributer which supplants a magneto. Note Auto-Lite starting motor and hot air stove for carbureter

Moline Makes Engine Changes

Abandons Oil Pressure Control—Adopts Battery Ignition in Place of Magneto—Front End Chain Layout Rearranged

THE new model G Moline-Knight four, while it follows the lines of the last model, has several changes in detail, especially with respect to the engine. This is, of course, a Knight type, and the dimensions of 4 by 6 in. are unchanged, but the detail has been modified at a good number of points. The most immediately noticeable change is that the magneto has been replaced by Connecticut battery ignition. The distributer is worm-driven off of the eccentric shaft, which actuates the sliding sleeves, and the same shaft which drives the distributer extends into the crankcase and drives a new type of oil pump which is another departure from Moline practice.

Oil pressure in the Moline-Knight is no longer controlled by the carbureter throttle. In the previous models a lever in unit with the throttle lever opened and closed an oil pump throttle with the purpose of giving a uniform addition of oil pressure with the acceleration of the car. In a few instances it was found that owners had difficulty in understanding this arrangement and abused it by mis-adjustment, consequently a gear-pump has been substituted which gives increased oil pressure as its speed increases.

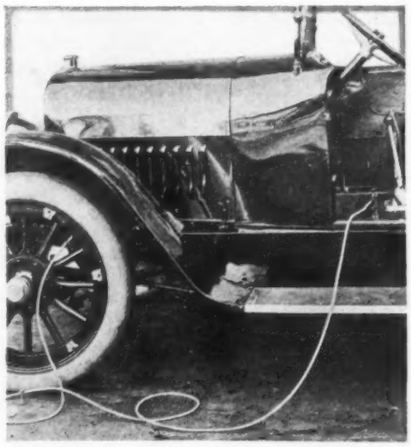
The silent-chain system for the front end is no longer a triangular layout. In the model 50 one chain acted through three sprockets, a drive sprocket, sleeve-actuating sprocket and generator-driving sprocket. The new method is to drive the sleeve shaft by one chain and the generator with another.

The exhaust manifold is now constructed to permit the separate exit of gases from each of the four cylinders, this being accomplished by the use of a casting with ports to each cylinder, which replaces a manifold that took care of two cylinders in one part. Better scavenging is the claim for the new principle.

The new intake assembly embodies a hot-air pipe which reaches over the top of the cylinders and connects on one end with a stove on the exhaust manifold and on the other with the air intake of the carbureter. The stove assembly is purely a cold weather fixture and the makers state that it should be removed for summer driving.

The new crankcase is built in halves instead of one casting as in the 1916 model 50. Maximum accessibility is claimed for this construction because it is only necessary to remove the oil pan to permit the complete removal of all the connecting-rods and pistons.

Another step in the way of accessibility is the new location of the combination oil filler and breather pipe, this having been located on the crankcase arm instead of in the center. With the old design the oil filler came directly under the water pipe, making it somewhat difficult to pour in the oil. The cast-aluminum fan has been discontinued and in its place is a pressed steel fan operating on a swinging bracket which permits ready belt adjustment.



Moline-Knight tire-pump hose may be attached without lifting the floorboards

All the above mentioned features constitute a change of the larger car to comply more nearly with the specifications of design of the model 40, which was the small car of last year. This latter will be continued with a few alterations which will be announced later.

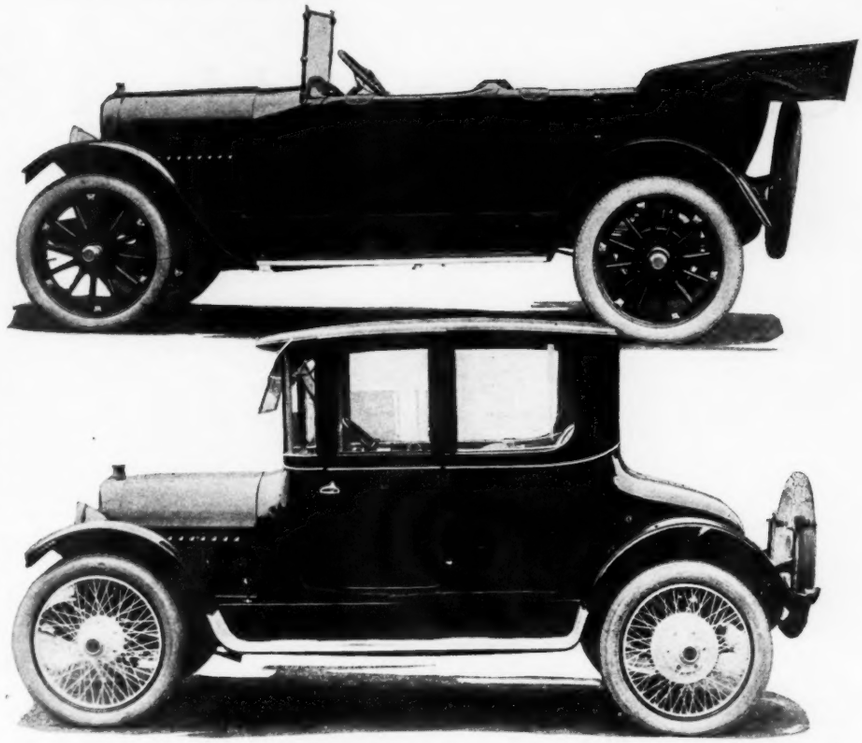
Something entirely new, however, is the adoption of the Bendix system of starting-motor drive in place of the manual shift which has characterized previous models. This was adopted because of its simplicity, there being less parts in the Bendix shaft assembly than in the manual shifting device. In

the electrical system, there is another marked change from the model 50 equipment. The generator is still a Wagner, but it is a 6-volt instead of a 12-volt machine and the wiring has the ground return principle instead of the two-wire system of the previous model. This is another step toward simplicity which has been the goal of the Moline engineering staff in the building up of this new model. The starting motor is an Auto-Lite design.

Moline Universals Used

The Brown-Lipe three-speed selective transmission is still mounted some distance behind the engine and is connected with it through two universals. These universals, however, are of Moline make in this latest model.

The rear axle is a floating type with spiral bevel drive, much the same in construction as on the model 40, but proportionately larger to take care of the additional power and weight in the new car. The gear reduction in the differential is 4 to 1 instead of 4.33 to 1, this higher gearing being made possible by the decreased weight, with an engine of the same size and even higher efficiency. The front axle is a duplicate of the large car of 1916.



Above is the new double-cowl touring body fitted to the new Moline-Knight chassis and below the new coupé with wire wheels

The characteristic double-compounded semi-elliptic spring design is retained in the model G. The springs are transverse and there are two of them, one above the other. They are of slightly different length and so different deflection period. The upper has a shackle attachment to the frame at one end and a pin at the other, and the lower has corresponding attachments to the axle. The effect of these two springs is to provide a very flexible suspension and yet roll and jumping is eliminated by the difference in deflection period. One spring damps the other, so to speak, when a severe shock is encountered.

Stewart Vacuum Fuel Feed

A new accessory which alters another principle of design is the installation of a Stewart vacuum tank which supplants the pressure system of the model 50. Gasoline is contained in a round tank instead of a square one and this tank is ingeniously fitted into the rear frame assembly and held in place by steel straps. The tank is fitted with a magnetic gasoline gage.

The Brush chassis and frame design in which the side members of the frame were extended to form the running boards is not evident in this model. Instead, the running boards are of wood. The shape of the frame, however, is similar to the previous model with the size altered to take care of the new chassis.

The tire pump mounting shows another well-planned effort to bring all accessories within easy reach. This accessory is now mounted on the gearset, so that the hose may be screwed into the nozzle without lifting the floorboards. The pump-operating lever is located at the side of the gear-shifting lever. In previous models the pump was under the hood and driven from the fan gear.

Double-Cowl Body

The new body marks Moline's acceptance of the double cowl. It is by far the best appearing body that these makers have yet produced. With a rolled-in edge sloping into the rear cowl, a rounded back, front cowl blending into the hood, crowned fenders and the characteristic all-curved line Moline-Knight radiator, the new car is entirely lacking in straight lines and has a massive, comfortable appearance. The sides of the body are 1½ in. higher than in the model 50, permitting lower seating of the passengers within the body which is becoming so much in demand. The upholstery is buttonless and deep. A mahogany panel has been fitted on the back of the rear cowl and in this are two flush rear-seat lights, one on each side. The windshield has been given a slight slant, hardly perceptible yet just enough to further carry out the effect of a total absence of right angles.

The spare tire is carried on a ring which serves the same purpose as a rim; that is, the tire and demountable rim are bolted directly onto it. A locking device is fitted, and this same assembly carries the tail lamp and license bracket. Because of its lighter weight the model G is fitted with 35 by 4½ in. tires instead of 36 by 4½, which size was standard on the model 50. With full equipment the model G sells for $1,750.

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Willys-Overland 75-B Delivery Car

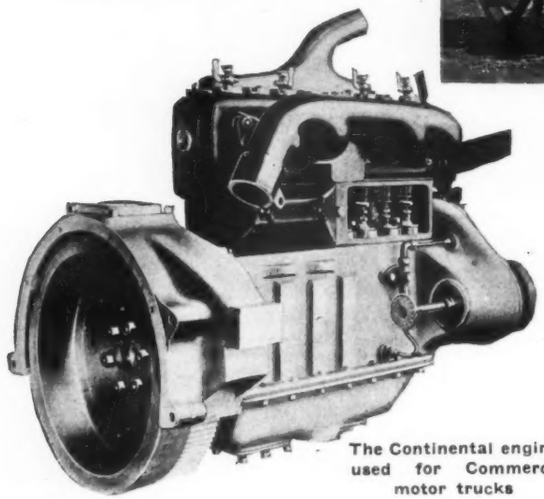
TOLEDO, OHIO, Oct. 16—The Willys-Overland Co. has put on the market the new Overland 75-B chassis fitted with a panel delivery body, selling at $625 f.o.b. Toledo. Features of the chassis which are not commonly found in low-priced delivery cars are the four-cylinder 31½-hp. block engine, electric starting and lighting system and 31 by 4 in. tires.

The panel delivery body fitted provides more than 78 cu. ft. of loading space back of the car. As the driver's seat extends only half way across the car there is additional space available extending to the toe board if required, the entire length of the floor on that side of the car being 97 in. The car is light and compactly built, has a short turning radius, making it easy to handle under all sorts of traffic conditions, and is designed to be economical in operation and maintenance. Tests have shown that it will run in continuous service at a cost of 1 cent or less per mile for gasoline and oil, according to the manufacturer.

Commerce Adds 1-Ton Model

Complete Electric Equipment Includes Starter—1-Ton Has Internal Gear and 1500-lb. Model Uses Bevel Drive—Power Plants Employed Are Identical

A 1-ton Commerce chassis selling at $1,175 with open body costing $60



The Continental engine used for Commerce motor trucks

IN addition to the 1500-lb. wagon, the Commerce Motor Car Co., Detroit, is now marketing a 1-ton truck. This is the first departure of this concern, which has been manufacturing vehicles for 7 years, from a single model policy and marks its entrance into a new field of light commercial car work.

Following the customary practice in light-capacity trucks the Commerce 1-ton model E is sold as a chassis, completely equipped with electric starting and lighting and a governor. This list price is $1,175 for the chassis alone and to this may be fitted a wide range of body styles. As standard the Commerce company is marketing an open body at $60 and a body with a four-post top and storm curtains at $100. Deliveries on this vehicle are scheduled for Nov. 15.

As far as the powerplant is concerned this truck is the same as the 1500-lb. chassis with the Continental unit, having a block of four cylinders 3½ in. by 5 in. This is an L-head design of medium duty characteristics and carries the clutch and gearset as a unit plant. Conventional design is used throughout and a good index to the construction of the engine is given in the main bearing dimensions which are: front, 2 3/16 by 2⅞; center, 2 7/32 by 2½ and rear, 2¼ by 3. This gives a minimum crankshaft diameter at the bearings of 2¼ in.

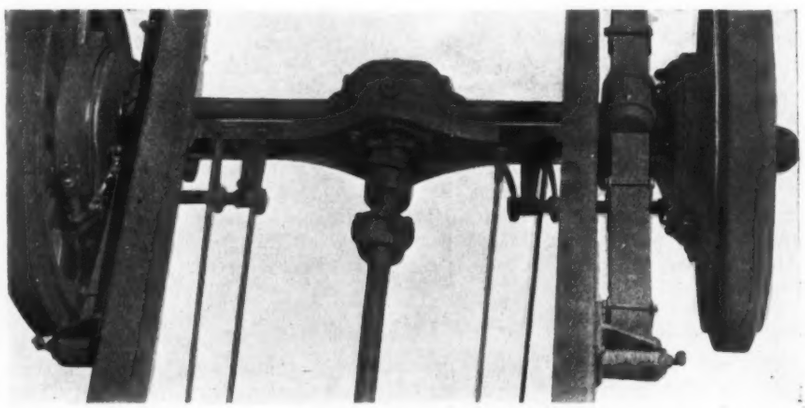
Following the dictates of common-sense in truck motor practice everything about the power plant is as simple as it is possible to make it. The oiling system for instance is a simple splash in which a constant level is maintained by a plunger pump. The only attention that the oiling system requires is to keep it filled with oil to the proper level, and occasionally to flush the crankcase with kerosene. The capacity of the reservoir which is in the lower part of the crankcase is 1 gal.

Fool-proof Ignition System

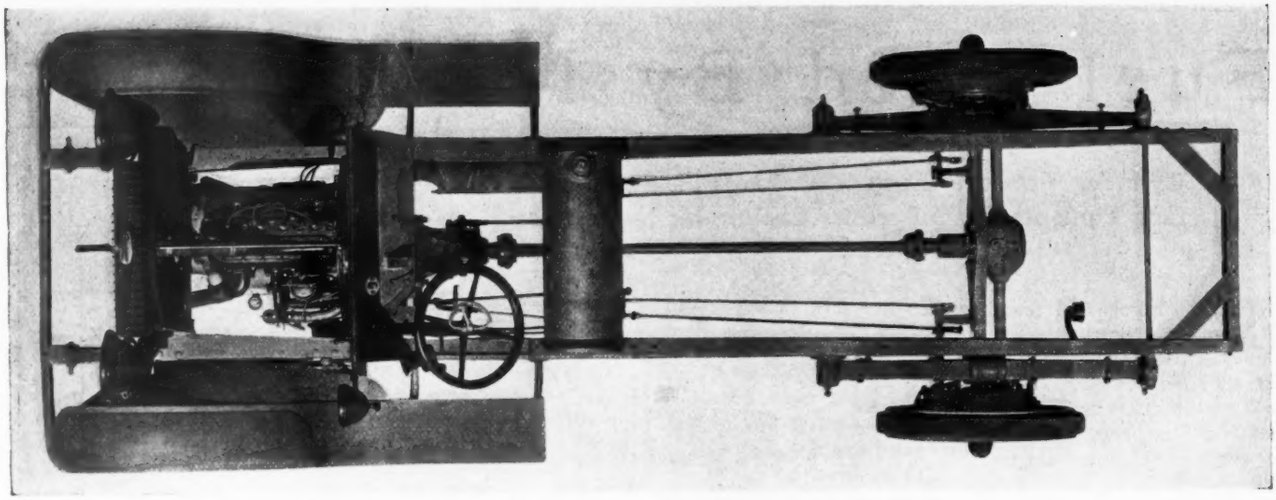
The ignition system is also a fool-proof installation, being a single high-tension Eisemann magneto with even the spark lever removed, as the timing of the ignition is fixed. Cooling is by thermo-syphon in connection with a vertical finned tube radiator with a removable cast top. The radiator construction is qute interesting, being an up-to-date adaptation of the cast tank and side member design. The component parts are illustrated herewith.

Three-Speed Gearset

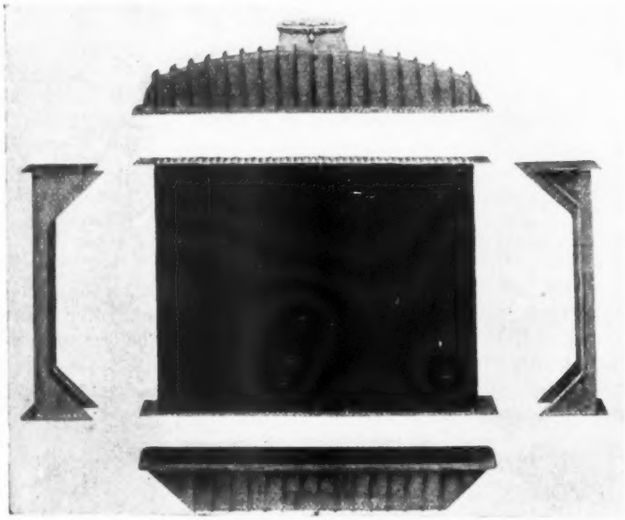
In the bolted-on bell housing are a leather-faced cone clutch and a three-speed selective gearset. From these the drive is transmitted through a propeller shaft and universal joint set manufactured by the Arvac Mfg. Co. The joints are made of drop forgings with felt washers and circular wire springs for retaining the grease. The shaft is hollow, having an outside diameter of 1¾-in. and a wall thickness of 3/16 in. From the rear universal the drive is transmitted to a Torbenson internal gear rear drive carried on roller bearings of Bower and Bock manufacture. A heavy wheel is used with 1¾-in. square spokes and the regular tire equipment is solid rubber of 34 by 3 front and 34 by 4 rear. When pneumatic tires are fitted at an extra cost, the tire



Rear construction of Commerce 1-ton chassis



Showing the substantial simplicity of the Commerce 1-ton chassis



Commerce special form of radiator

sizes are 34 by 4½ front and 35 by 5 rear. The front axle is an I-beam and it is equipped with Bower roller bearings in the hubs.

The frame is a high-carbon steel of channel section. The thickness of the stock is 3/16 in. and, as this material has a tensile strength of from 60,000 to 80,000 lb. per square inch, a high factor of safety is allowed with the depth of 4½ in. The flange width on this frame varies in regards to its position on the car. At the front end it is 2¼ in. at the center 3½ and at the rear 2, giving lateral as well as vertical stiffness.

A double set of concentric brakes is used on the rear wheels. The internal is 15½ by 2¼ in. and the external 16 by 2½ in. These are connected with the brake control mechanism by direct-line linkage and are secured against rattles. The spring eyes and shackles are also secured against wear and looseness by using bronze bushings at all points and protecting these by oil cups.

In the way of fittings and equipment the car is unusually complete for a commercial vehicle. The Remy electric equipment is used for starting and lighting in connection with a Willard storage battery. The carbureter is a Zenith which is also in line with the simplicity of the entire chassis as there are no adjustment points beyond those fixed at the factory. For gasoline feed the Stewart vacuum system is used, operating in connection with a 15-gal. welded steel tank located beneath the driver's seat. The lamp equipment consists of side and tail running lights with a powerful searchlight for picking up house numbers, street signs, etc. The standard bodies have a loading space of 44 by 110 in.

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Automobile Performance

(*Continued from page* 659)

J. B. Replogel, director of research, Remy company, asked what we would do with the formula after we got it. The *C* factor must be taken into consideration and therefore we would have to assume units for noise, vibration and endurance.

William B. Stout, sales manager Scripps-Booth, said that in all probability the *C*, or comfort factor, would be the deciding one. It would be impossible to reach the same effect by formula that riding in the car would secure. A formula also leaves out the element of personality, which is largely to be desired and which is a factor in the sales of a car company in the same way as it is of a piano concern. Even the height of the car is responsible for impression in riding and Mr. Stout pointed out that the effect of riding in a car which is too high or too low has the effect of nervous strain which produces mental fatigue that would never be registered in the performance formula.

C. C. Hinkley, engineer of the Chalmers company, stated that when cars are designed they are designed around a formula and for that reason there is no good reason why the same formula could not be used as a rating method. The formula he uses is:

$$\frac{\frac{D \times R}{W \times d}}{T}$$

Where *D*, is displacement, *R* is gear ratio; *W*, weight; *d*, wheel diameter and *T*, the time in seconds necessary to accelerate from 5 to 50 m.p.h.

V. R. Heftler, president of the Zenith Carbureter Co., stated that it may after all be better to give performance rating in the form of a curve rather than in a mathematical expression.

E. M. Planche, chief engineer of the Dort company, stated that he used the $S \times A \times E$ formula divided by *L*, the low, high-gear performance with very good results. The wind resistance factor should also be regarded important.

O. E. Hunt, assistant engineer of the Packard company, said, "No engineer would contend that performance is the sum total of car value. Besides this it is made up of reliability, comfort and appearance. The factors involved in performance are speed range, acceleration and economy, *i.e.*, *S. A.* and *E*. Only the latter can be measured mathematically and can be considered in a formula."

Fuel Feed By New Method

Cylinder Pressure Employed To Fill Supplementary Tank in Turn Feeding Carbureter by Gravity

THE Church fuel feed system is a new method combining gravity and pressure feed in an ingenious way. It involves a supplementary fuel tank which may be mounted on the dash or other convenient point, and from this gasoline is fed directly by gravity to the carbureter. A float level is maintained within the supplementary dash tank.

It differs from one other system in that instead of using the suction of the engine to transfer fuel from the main tank to the auxiliary tank, this is maintained by an automatically regulated pressure caused by the compression and explosion pressure in one cylinder. This pressure is obtained through a very ingenious check valve mounted usually in place of the petcock in the rear cylinder and through which the burned gases maintain pressure on the main fuel tank and force gasoline to the auxiliary tank in the same way that fuel is forced directly to the carbureter in the conventional pressure system.

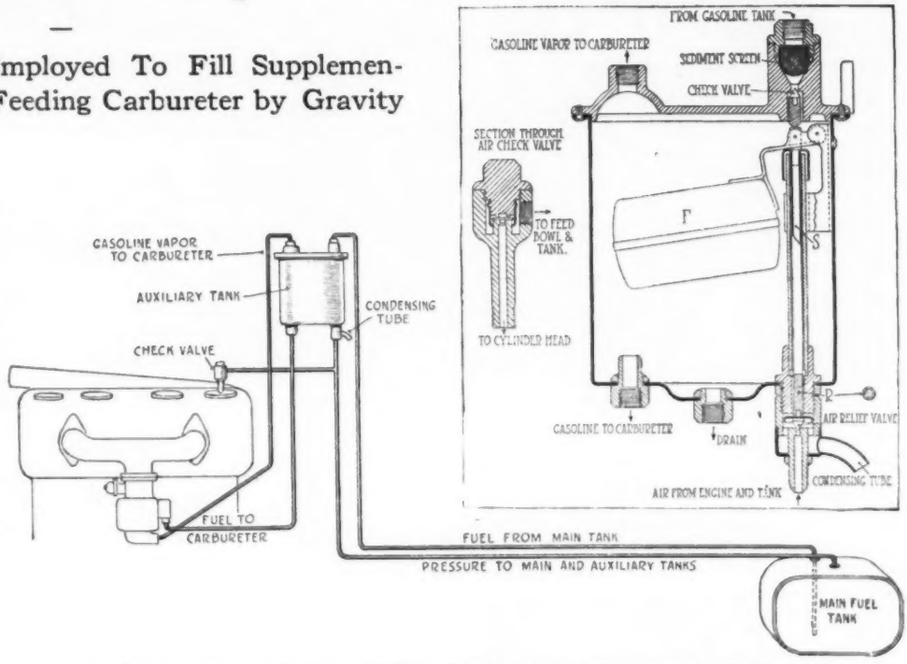
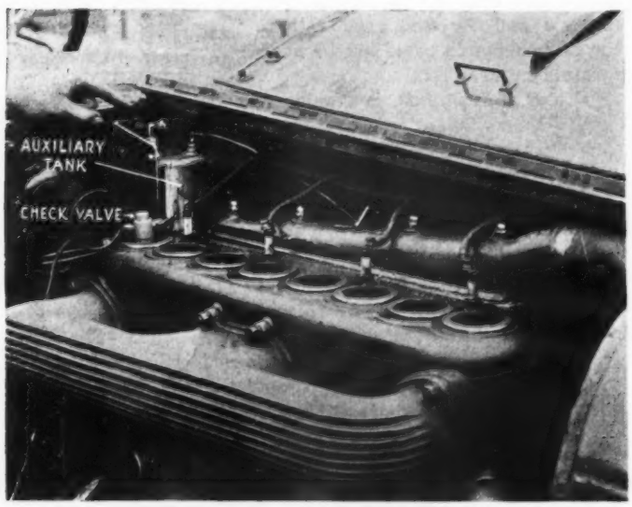


Diagram of Church fuel feed system with a section through the auxiliary tank

It has the distinction, however, that a constant gravity feed is provided to the carbureter and there is no hand-pump required.

A feature of the system, which will have the most general appeal, is the fact that an adequate supply of gasoline is assured to the carbureter, even though the auxiliary tank be empty at the time of start, and even though the main fuel tank may have been open for filling and the pressure thus relieved. This comes about through the fact, first, that the fuel in the carbureter float chamber is more than sufficient to start the gasoline running from the main tank to the auxiliary tank, where it runs by gravity to the carbureter and, second, that in the absence of sufficient fuel in the carbureter float chamber to start the engine, the operation of the starter for 15 sec. or less will generate pressure sufficient to put fuel in the auxiliary tank.



Church fuel feed system on engine, showing auxiliary tank on dash. Note check valve

Flow Is Constant

A point that is considered most important by the inventor is the fact that, being independent of engine suction, the engine can be run indefinitely on wide-open throttle without diminution in the fuel supply, caused by the combined decrease in suction and increase in fuel demand which occurs with wide-open throttle. On the contrary, the system is arranged so that increased demand on the auxiliary tank automatically permits increased pressure in the main tank, thus increasing the flow of fuel to the auxiliary tank.

That the system is capable of supplying fuel under conditions of maximum demand was demonstrated recently in an official A. A. A. test on the Chicago Speedway under the direct supervision of F. E. Edwards of the A. A. A. technical committee, and witnessed by a representative of THE AUTOMOBILE. In this test, a Mercer 22-70 roadster, fitted with the Church system was driven a distance of 10 miles in a total elapsed time of 7 min. and 58.4 sec., an average speed of 75.4 m.p.h., with a maximum speedometer reading of 84 m.p.h. As may be imagined, this required wide-open throttle practically the entire 10 miles, and there was no spitting or other evidence of starvation during the trial. At the end of this distance the auxiliary tank was still full.

The system is arranged so that the ordinary maximum pressure is not over 1½ lb. per square inch, but in the test referred to, the pressure as indicated by a gage on the dash, ran up to nearly 3 lb. indicating the automatic increase in pressure to meet an increased demand. In order to further illustrate this point, a Jeffery six touring car was fitted with a mast, upon the top of which the Church tank was installed, so that the tank was 10 ft. 9 in. above the level of the main

tank. With the auxiliary tank empty, pressure relieved from the main tank and the engine dead, it required 14.4 sec. to get fuel into the auxiliary tank after the starter button was depressed, at the end of which time the pressure indicator showed a pressure of 1½ lb. per square inch. In running the car at a speed of 55 m.p.h. a maximum pressure of 3 lb. was registered.

Essentially a Closed System

Another advantage with which the system may be credited comes from the fact that the system is essentially a closed system, and neither the main tank nor the auxiliary tank is open to the air; consequently, there is no chance of taking in road dust. The system is closed in another respect, in that a vent is provided in the top of the auxiliary tank, but this vent is connected to the air intake of the carbureter, so that any gas which evaporates from the system passes directly into the carbureter through the air intake, and thus adds its quota to the fuel supply instead of being wasted. Inasmuch as the evaporation of gasoline over a warm engine is a considerable fraction of the fuel possibility, this feature is an item of economy.

The diagram on the opposite page shows the general layout of the system, together with a cross-section of the Church tank on the right, and the air check valve on the left, while the illustration at the bottom of the page shows the tank installed on a Mercer car. In the sectional view it will be noticed that the pressure line is in the form of an inverted T with the check valve at one end, the main tank at the other and the Church tank at the end of the stem. It is in the Church tank that the pressure regulation occurs, and it is determined by the position of the float *F*. As the float descends with lowering of the gasoline level, the stem *S* moves downward, pushing downward on pushrod *R*. This in turn seats the air relief valve and prevents pressure escaping through the condensing tube, so that, with the float in its lowest position, all of the pressure from the check valve goes into the main tank.

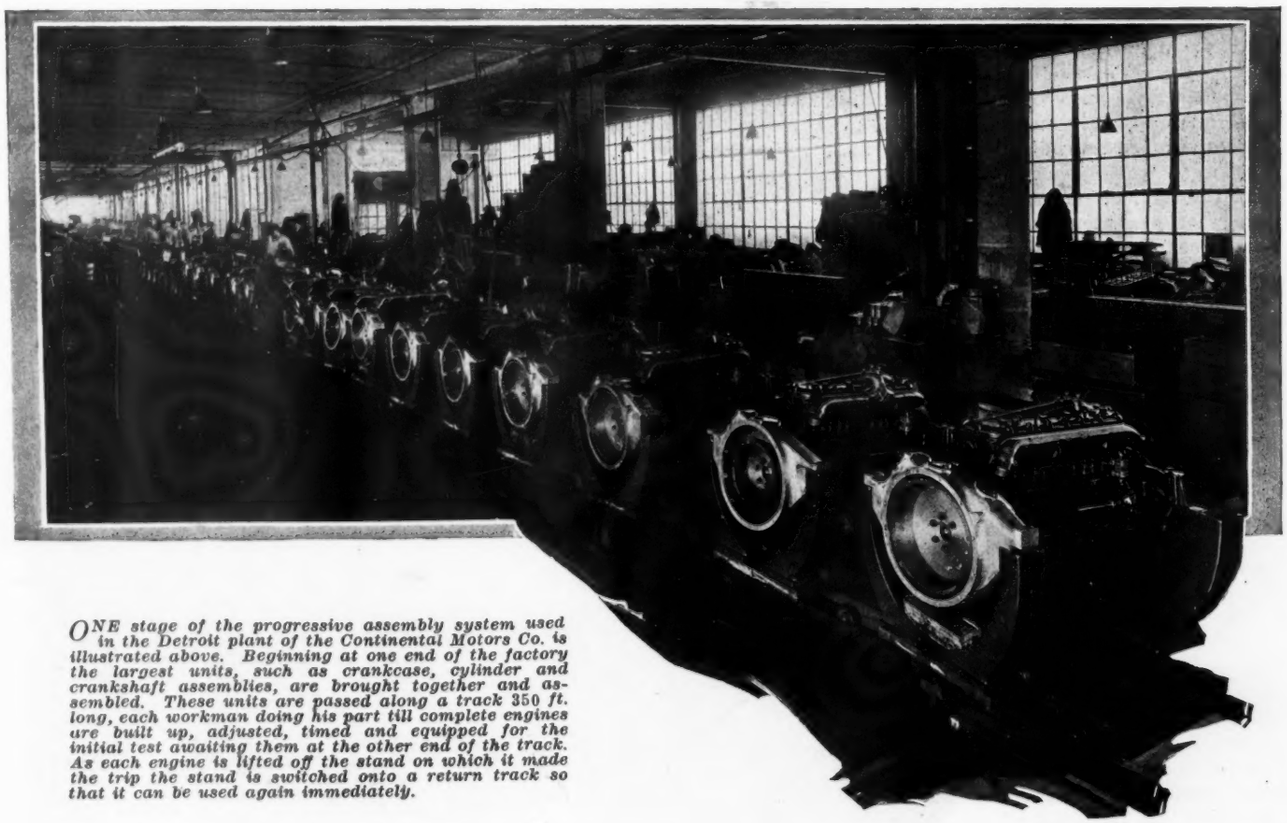
When the float is at its upper position, the air relief valve is forced upward by the pressure, permitting the latter to escape through the condensing tube. The conical form of the air relief valve graduates the amount of pressure being used in proportion to the position of the float; that is, in proportion to the height of the gasoline level in the auxiliary tank. It will be noted that a gasoline check valve is provided at the gasoline intake operating in harmony with the air relief valve. It will also be noted that cleaning arrangements are accessible, for the sediment screen can be removed without disturbing the tank, as can the air relief valve.

The designer attributes the possibility of this system to the design of the check valve. This is a flat nickel disk, 1/32 in. thick, and having a maximum opening of only 0.003 in. It is calculated that the valve takes approximately 0.005 of the cylinder volume.

Sight Feed Furnished

In connection with the system a gasoline sight feed on the dash is supplied if desired, and this has the advantage of giving a warning that the main tank is empty, at which time there is approximately a pint of fuel in the auxiliary tank which serves as a reserve. The system was developed by Edmund S. Church, Automatic Carbureter Co., Chicago, Ill.

Progressive Assembly Used for Continental Engines



ONE stage of the progressive assembly system used in the Detroit plant of the Continental Motors Co. is illustrated above. Beginning at one end of the factory the largest units, such as crankcase, cylinder and crankshaft assemblies, are brought together and assembled. These units are passed along a track 350 ft. long, each workman doing his part till complete engines are built up, adjusted, timed and equipped for the initial test awaiting them at the other end of the track. As each engine is lifted off the stand on which it made the trip the stand is switched onto a return track so that it can be used again immediately.

A corner of the Studebaker custom body department, showing bodies being trimmed

Studebaker Custom Bodies

Demand for Special Styles Leads Factory To Install Custom Department—Represents Saving

BUYERS of Studebaker cars are no longer confined to the limitations of stock bodies. Owing to the increasing demand for individuality in external appearance, as manifested on the part of purchasers of its cars, the Studebaker company has made the departure of incorporating within its plant a custom body department in which the range of ideas of purchasers can be met with a corresponding style of body in both open and closed models.

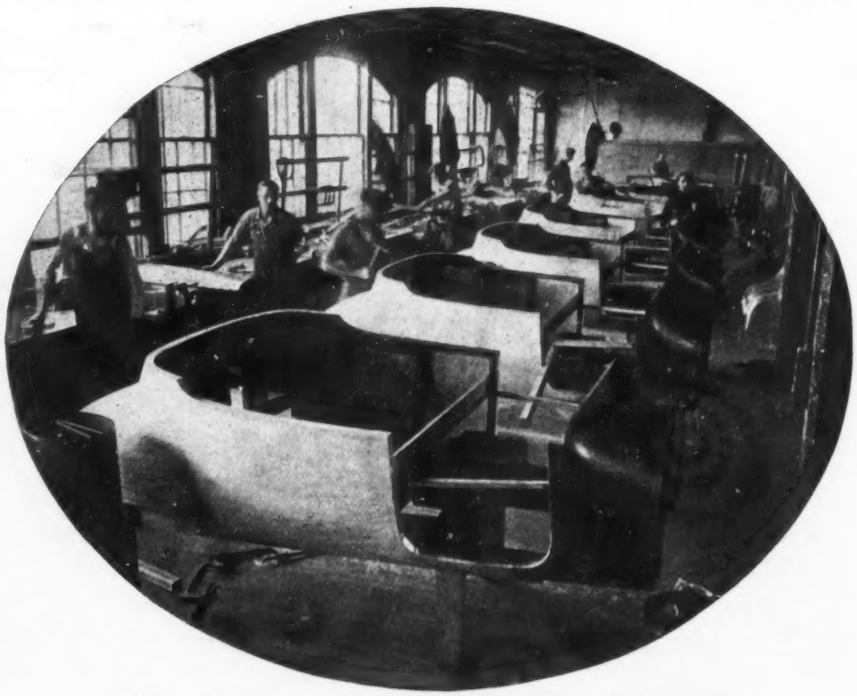
Heretofore automobile manufacturers who are classed among the big producers have done a relatively small amount of custom business and where it has been done the bodies have been bought from builders outside the organization. In 1913 the Studebaker company started a body department of its own in which the stock bodies were made, but up to the present time the custom-made bodies have been purchased on the outside.

During the last year there has been a rapidly increasing demand for special body design and it has been felt that the expense of organizing the custom body department will be immediately met by the increasing demand for these bodies. This has already proven to be the case.

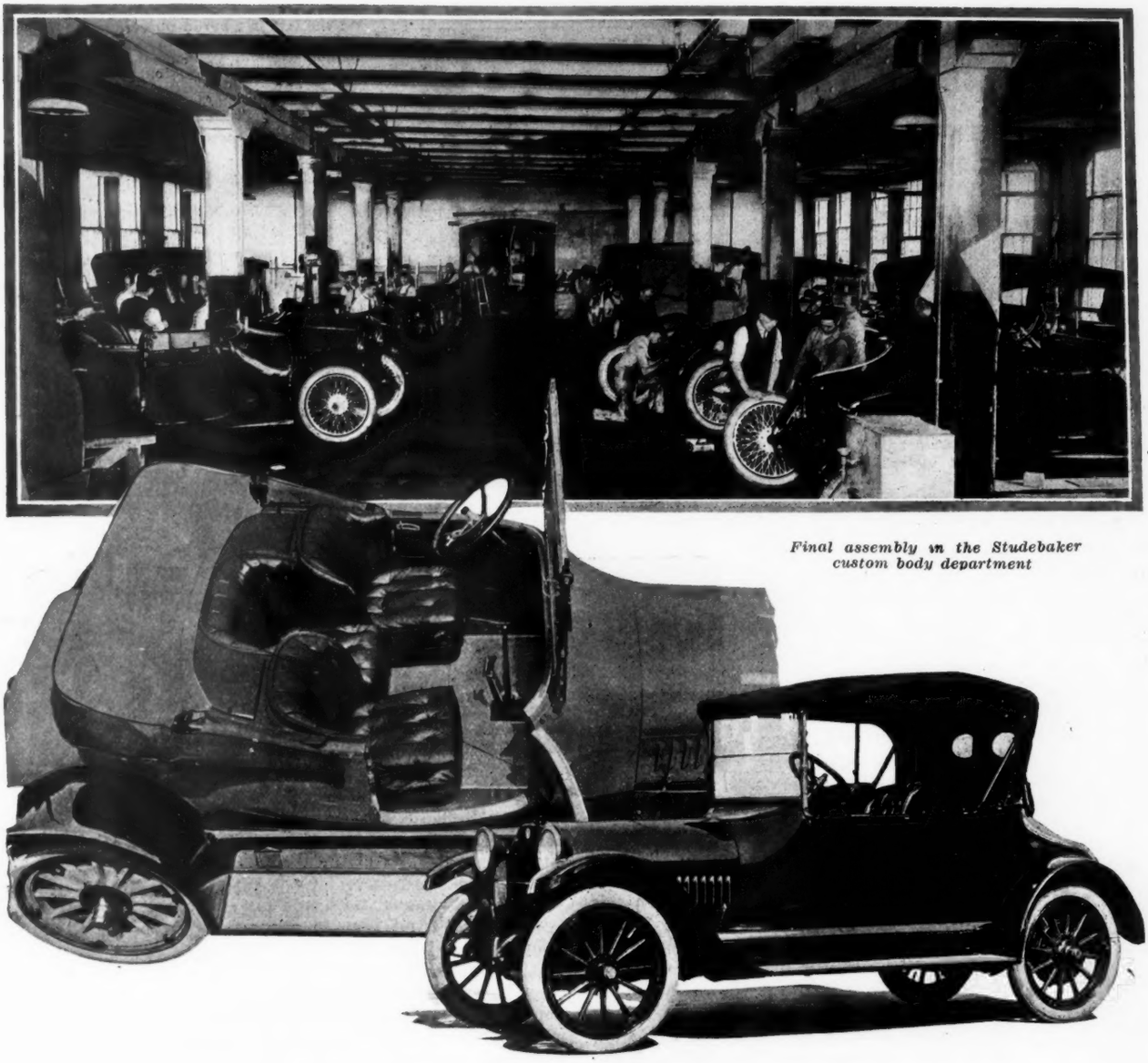
The method of procedure in securing the specially-built bodies is for the purchaser to describe the type he desires. He is then furnished with a rough sketch prepared by the Studebaker designers and when this is approved it is drawn to full size before the structural drawings are made. In carrying out the work of producing these new bodies, several distinctive shapes have been created, and in each case special style tops have been designed to accommodate the body contour.

Of chief interest to the purchasers is the fact that the selling price of the completed product is below the combined price of the chassis and a similar body purchased outside because of the elimination of the middleman's profit. The deviations from the stock body are not only in shape and seating arrangement, but also in color. The standard body is dark blue, while the custom-made bodies are finished in any color scheme that may be desired. The materials used in the construction of these special bodies are carefully selected in the same manner as they are by any of the custom body manufacturers, and although the price of these special jobs will range from $100 to several hundred dollars more than the stock body, there is an ever increasing number of buyers who are willing to pay the difference.

Some of the special bodies which have already been produced are shown in the accompanying illustrations. One of these is a three-passenger cloverleaf roadster which is characterized by the fact that the center seat is not placed as far back as is usual in the three-passenger cloverleafs and hence allows a maximum amount of sociability in seating with the minimum of body length. The small compartments formed on either side of the center seat by its staggered arrangement, which spaces are sometimes allowed to pass entirely unutilized, are utilized for package carriers and can be reached by lids which set



Where the metal-working is done. Bodies are of sheet aluminum

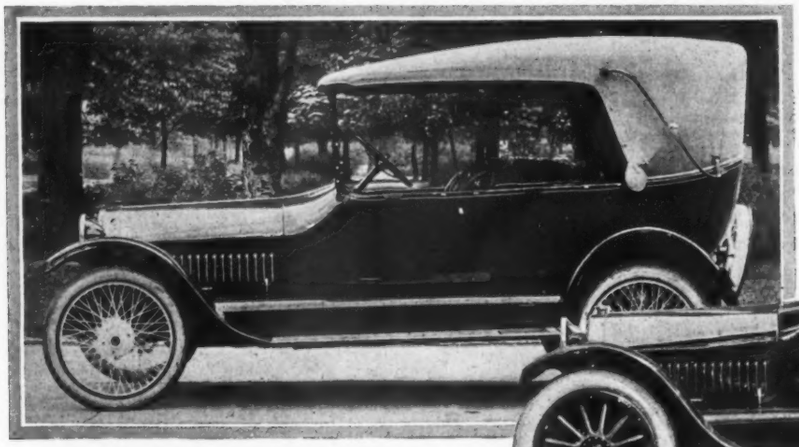


Final assembly in the Studebaker custom body department

Above at the left is a three-passenger cloverleaf type of body made in the Studebaker custom body department and fitted to a standard chassis

At the right is a custom-built four-passenger roadster design mounted on a Studebaker chassis. This car is entirely a product of the company's factory

At the left is a section of the wood-working shop in the new custom body department of the Studebaker factory. The sheet aluminum bodies are fitted over the wooden frames, parts of which appear in the illustration

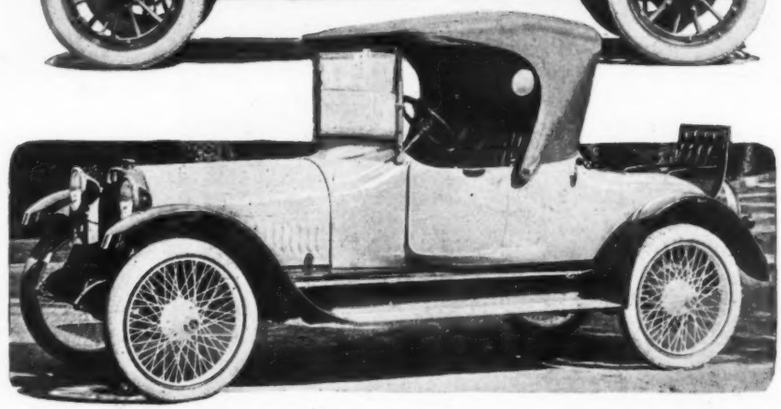


At the left is a seven-passenger touring body fitted with a Heaslet top, the latter being named after J. G. Heaslet, vice-president in charge of engineering and production. It is finished in red

The body illustrated at the right is a seven-passenger Studebaker model fitted with a victoria top

in from the top, a convenient arrangement.

An example of special top construction is shown on a seven-passenger body. This is finished in red and the top itself is what might be called an extended victoria, as it opens with the exterior bows in the same manner as a victoria top, but the peak is extended to the top of the windshield. A top somewhat on this style is shown on a custom-made roadster body which is fitted with a rather novel lackey seat in the rear. The extra seat is primarily intended to accommodate a servant and when not in use it is folded down out of view. The feature of the seat is that the part which folds up uncovering the seat well forms a convenient back rest for the occupant. A particularly wide door is used on this model and the curvature of the side line of the body is also very well worked out.



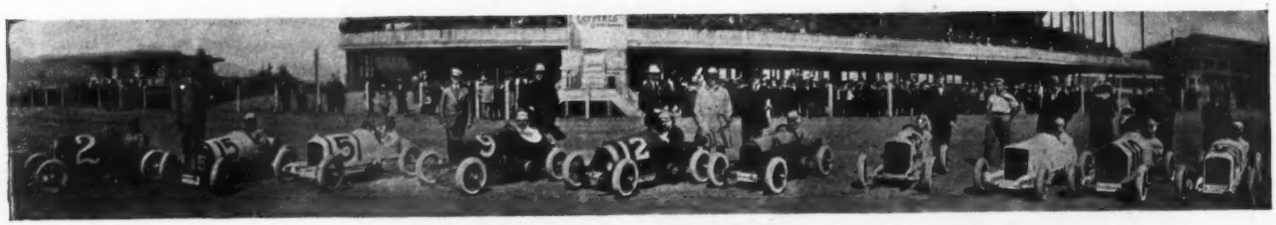
A custom-made roadster produced by the Studebaker custom body department. Note the lackey seat in rear for a servant. When not in use this seat folds into the rear deck, leaving the surface smooth

In the way of special roadsters, the four-passenger design has proved to be quite popular. The type shown in the accompanying illustration is exceptionally roomy and almost approaches a close-coupled touring car with the exception that there are no rear doors, the entrance being through the front and between the divided front seats. No difficulty is found in seating two passengers in the rear seat of this body, as it is of generous width and far enough removed from the back of the front seat to allow the passengers plenty of knee room.

A rather staid and formal type of body is illustrated in the seven-passenger design with victoria top. This is a very popular design with ladies who utilize it for afternoon calls and shopping, giving an effect of an open town car. As will be noted, it is equipped with bumpers both in the front and rear, in order to take care of the minor collisions which often occur under conditions of crowded traffic.

Miniature Racing Cars Make 70 M.P.H.

TEN miniature racing cars, using Indian motorcycle engines and 20 by 4-in. Goodyear cord aeroplane tires on miniature wire wheels, attained a speed of 65 to 70 m.p.h. in a series of races held recently at San Francisco. As can be seen from the illustration published herewith, these little cars were constructed in accordance with the latest dictates of design as adopted in the standard speed creations now breaking records at over 100 m.p.h. on the speedway circuit. While very lightly built, they are made low to keep the center of gravity near the ground and the bodies are built to offer minimum resistance to the wind. Although the tires used were not built for race track service, they stood up excellently under the strains of high speed work, as experienced in the contests fought out by the Lilliputian racing cars.



Ten miniature racing cars which battled for supremacy in a series of races held recently at San Francisco

Resta Wins 250-Mile Grand American Race

(*Continued from page* 655)

Hudson to such an important position in the Sheepshead Bay Race, drove the last 150 miles on five cylinders, and finished in tenth position. He broke a bushing in the valve lifter assembly and after 20 minutes of frantic effort, he and his mechanic removed the lifter guide and re-entered the race with one valve in operation.

Nine Stops for Plugs

Spark plugs again had a hand in swelling the number of pit stops. There were nine stops for plug changes.

To-day was a day for fires at the Maywood track. The Crawford with its unlucky 13 was the only one which was serious, but the other two had possibilities of danger. Devore's Duesenberg caught on fire early in the race at the pit when the driver had flooded things in general in working with his carbureter. When he finally started the engine the gasoline around the engine caught fire from the backfire and a lively conflagration was started. Luckily this was almost in front of the J-M pit and the fire extinguishers had the flames out before they had gained any headway.

The other fire was an incipient conflagration which started from a carelessly thrown match or cigar in the bunting which decorated the front of the grandstand. Attendants had the burning bunting ripped off before any damage was done and there was little excitement in the grandstand. Probably only a few of the spectators, and those immediately behind the place where it occurred, knew anything had happened.

Race Well Handled

Aside from this there were no untoward accidents and no possibilities of any other than the usual risk when a score of cars are traveling at high speed. The race as a whole was very well handled, the track perfectly guarded, the timing seemed perfect, although the scoreboards and announcing were many laps behind the progress of the race. The scoreboards were the worst in this respect, being neither up to date nor always correct.

DePalma was not the only driver who had hard luck after a wonderful showing. Wilcox with only one lap to go to finish in fourth place had to withdraw with a broken connecting-rod. Galvin very nearly had a similar experience, as his car went out while he was making an additional lap after he had been flagged in fourth, and had to push his car part way around the course.

Mulford, who was slated to drive a Duesenberg, did not appear at the starting line and Devore took his place. The Ben Hur, which was a local entry, and fathered by President Reid of the speedway, was not in shape to start. This was to have been driven by Louis Chevrolet. Rickenbacher's Maxwell was not in the best of shape when he started, and much credit is due him for jockeying it into third position.

Attendance Under 10,000

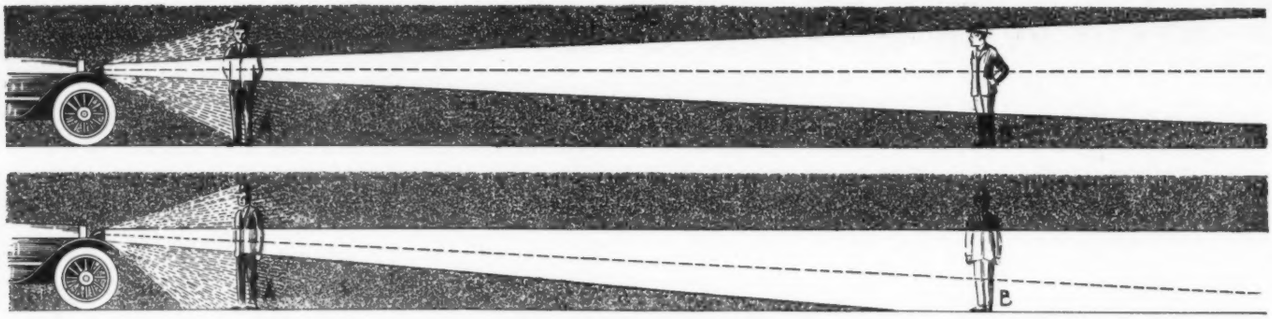
The attendance at the race is judged as below par. It is regretted that more than 8000 to 10,000 did not see the birth of this particular race, the Grand American. But if such another race as this of to-day is ever foreseen in the announcement of an event at the Chicago speedway, the fame of the performance to-day will guarantee a record-breaking gathering.

Everywhere were sportsmen and sportswomen. That is the impression the Grand American would probably give most general observers. Most of the crowd were automobilists, if the parking space can bear witness to it, for back of the stands cars were parked within touch of each other along practically the entire stretch there. Enterprising guardians at the entrance to the speedway reaped dollars for space in vacant fields nearby, vacant fields that were well filled by 2 o'clock. As usual the allotments infield showed many cars.

Resta's car was equipped with Silvertown tires, Miller carbureter, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum. Aitken's car used a Zenith carbureter, Goodyear tires, Bosch magneto, K L G plugs, R-W wheels, Levett pistons, and used Oilzum.

Times Every 20 Miles of 250-Mile Grand American Race at Chicago

Car	Driver	Miles 20	40	60	80	100	120	140	160	180	200	220	240	250	M.P.H.
Peugeot	Resta	11:36	23:06	34:28	45:56	57:19	1:08:42	1:21:12	1:32:42	1:43:59	1:53:08	2:07:01	2:18:30	2:24:16.68	103.99
Peugeot	Aitken	11:37	23:08	34:29	45:56	57:20	1:08:43	1:20:10	1:31:38	1:43:06	1:54:53	2:07:03	2:18:38	2:24:32.61	103.65
Maxwell	Rickenbacher	11:39	23:09	35:45	47:26	59:55	1:10:20	1:20:48	1:32:29	1:45:25	1:56:57	2:08:29	2:20:05	2:25:52.76	102.08
Premier	Lewis	12:19	23:16	36:30	47:52	1:00:01	1:13:22	1:24:07	1:36:14	1:49:24	2:01:28	2:13:16	2:26:36	2:32:28.93	98.37
Maxwell	Henderson	12:02	24:13	36:22	47:35	1:00:57	1:13:05	1:25:12	1:37:27	1:49:23	2:01:19	2:13:14	2:26:41	2:32:31.39	98.34
Premier	Galvin	12:20	23:24	36:45	47:55	1:00:03	1:13:24	1:25:22	1:37:28	1:49:35	2:01:38	2:13:41	2:27:07	2:33:20.50	97.81
Duesenberg	Devore	12:00	23:09	36:18	50:51	1:02:36	1:17:36	1:32:36	1:47:14	1:59:09	2:11:49	2:23:45	2:35:53	2:45:35.43	90.58
Ogren	Burt	11:38	23:14	37:16	51:00	1:03:39	1:17:25	1:36:08	1:48:41	2:03:40	2:17:35	2:30:08	2:37:44	2:52:05.35	86.66
Erbes	Gable	11:51	24:06	36:19	51:53	1:06:37	1:21:36	1:38:14	1:52:22	2:08:09	2:22:54	2:38:38	2:56:23	3:04:52.23	81.13
Hudson	Vail	12:26	23:08	36:19	48:29	1:23:13	1:37:31	1:50:36	2:06:12	2:20:23	2:32:28	2:46:46	2:58:55	3:05:37.37	80.81
W. Duluth	Rawlings	12:09	24:07	36:12	47:38	1:09:29	1:26:42	1:41:05	1:55:22	2:10:55	2:55:16	2:39:46	3:02:45	Flagged	
Duesenberg	Busane	12:31	29:04	42:05	54:35	Running a	t finish—fla	gged							
Peugeot	Wilcox	11:50	23:52	35:38	47:18	58:56	1:10:35	1:22:18	1:34:04	1:45:49	1:57:42	2:09:45	2:21:26	Out, broken c	onnect-
Peugeot	DePalma	11:34	23:03	34:23	44:37	55:50	1:07:08	1:19:37	1:33:00	1:43:28	Out at 194t	h mile, bro	ken valve	ing-rod	
Ostewig	Ostewig	11:53	30:55	52:12	1:21:28	1:37:34	1:50:36	2:10:16	2:23:58	Out 172nd	mile, slippi	ng clutch			
Crawford	Kline	12:03	23:09	36:38	47:45	1:00:05	Out 112th	mile, broke	n crankshaf	t					
Crawford	D'Alene	11:38	23:31	36-17	56:24	Out 90th m	ile, broken	shaft							
Duesenberg	Milton	11:45	23:05	Out 42nd	mile, clute	h facing tor	n out								
Hoskins	Hughes	11:37	.....	Out 40th	mile, broke	n connectin	g-rod.								



Above—Fig. 1—Diagram of the light cast by a good lamp, the direct rays from the bulb furnishing adequate illumination without glaring to eyes outside the limits inclosed by the heavy lines. Below—Fig. 2—Tilting the lamp downward so that the edge of the beam, instead of its center line, is parallel to the ground, eliminates glare

Eliminating Glare Is Easy

A Simple Language Explanation of What Causes Glare and How to Prevent It—What S. A. E. Is Doing To Assist Manufacture of Non-Glaring Lamps

By A. Ludlow Clayden
Chairman S. A. E. Standards Committee

GLARE from an automobile headlamp is caused by the concentrated rays in the beam of light striking the eye of the observer and preventing the lesser light from illuminated objects close to the lamp from affecting the eye strongly enough to give vision. A headlamp lights up objects on the road. An observer facing the lamp can see those objects as long as the reflected light reaching his eye is not overpowered by the light coming direct from the lamp.

Provided the direct light is kept out of the eyes of the observer, the stronger the light that the lamp casts on the road the better can the road be seen by the observer facing the lamp as well as by the driver of the car behind it.

Thus to make the night use of automobiles safe, it is as requisite to have enough light thrown on the road as it is to prevent too strong a light from being cast into the face of anyone on the road.

Arrangement Is Everything

A properly arranged lamp of great candlepower will be less disconcerting to anyone approaching it than will an improperly arranged one of small candlepower.

The light of a headlamp is a concentrated beam surrounded by a general spread of unconcentrated light. All that we need to do to eliminate glare is to keep that concentrated, central beam so directed that none of its rays reaches the eyes of a person in front of the lamp, the general spread of unconcentrated light will be helpful and not harmful.

This can be done very simply if the lamp is sufficiently well made. If the lamp is badly constructed it is impossible, not merely difficult but impossible in the fullest sense. Just why this is will be shown later.

Fig. 1 is a diagram of the light cast by a good lamp. The direct light from the bulb illuminates objects surrounding the lamp and close to it. The concentrated light does not touch the road for some distance, not till the beam has spread out. The edges of the concentrated beam are shown by heavy lines, and the center line of the beam by a dotted line. The lamp will not glare to anyone whose eye is outside the limits inclosed by the heavy lines.

With the lamp placed square to the car this means that a pedestrian will not notice any glare when the car is close to him, but he will notice it when the the man *B* is unable to see anything except the lamp and suffers extremely. This is because the upper edge of the beam is not as high as *A's* eyes but is higher than *B's*.

All we need to do then, is to so set the lamp, or so construct it that the upper edge of the beam cannot ever rise as high as a man's eyes however far away he may be.

Therefore, if we tilt the lamp downward as in Fig. 2, so that the edge of the beam is parallel to the ground instead of the center line of the beam, we have cured that lamp of glaring so far as any approaching pedestrian or driver is concerned.

This seems too absurdly simple to be true. It is true enough though *if* we have a lamp that really does give a beam with a sharp edge. The bulk of the trouble with headlamps is that they cast irregular beams and it is the purpose of the Society of Automobile Engineers to define limits for lamp manufacture that will make the beam sufficiently accurate to enable simple lamp adjustments to give the upper edge of the beam its proper position without uncertainty.

The lamps as made to-day are not reliable, because while any one lamp may be set to give the correct light distribution with one bulb, when the bulb is changed the light may alter altogether. This is because the position of the beam changes as the filament of the lamp is moved.

Fig. 3 shows the same lamp with the same setting and the sort of light it will give when the bulb is moved so as to put the filament into different positions. At *A* we have the right spread of light. At *B* the filament is too far forward and at *C* it is too far back, the result in either case being to widen the beam so that it is no longer within safe limits; thus converting a non-glaring lamp into one which will glare very badly. If the filament is truly in the central axis of the bulb we can cure this by focussing.

The average man is so helpless when it comes to focussing that he would be better off almost without any focussing device whatever, for he then would not maladjust a good lamp which he is likely to do if the chance is given him.

By adding to the cost of manufacture of bulbs a little they can be produced so that adjustment is not necessary. So that any bulb will go in any one reflector and give the same sort

of light as its predecessor. This means that one reflector or focussing adjustment would last the life of the lamp.

Next comes the reflector itself. If this is pressed accurately to shape the beam of light will be true and handlable, but if the reflector is irregular, of one curvature at one place and another somewhere else, then the beam will throw out odd rays of glaring light. This means that limits of accuracy should be imposed upon reflectors.

Another thing about reflectors is the kind of curvature they have. If a reflector is very deep, then moving the filament of the lamp has less effect on the beam than when the reflector is shallow. Some of the reflectors in use to-day are so shallow that even an expert in a laboratory has difficulty in adjusting the bulb so as to get a proper beam. This means that if we hold the bulb tolerances down to say 1/64 in., the reflector should be deep enough so that a 1/64 in. variation of filament position makes no difference to the light. With a bulb held to tolerances, and a reflector held similarly we can be certain that a lamp once set properly will remain set properly.

So much for keeping down glare. There is something else just as important, however, and this is to insure enough light for driving that will be safe to the car carrying the lamp as well as to other road users. This means that the car must throw a light far enough ahead to make clear any objects on the road within not less than 200 ft. and that the sideways spread of the beam must be enough to illuminate objects at the sides of the road. The man meeting the car wants to see where he is walking just as much as the driver wants to see where he is steering.

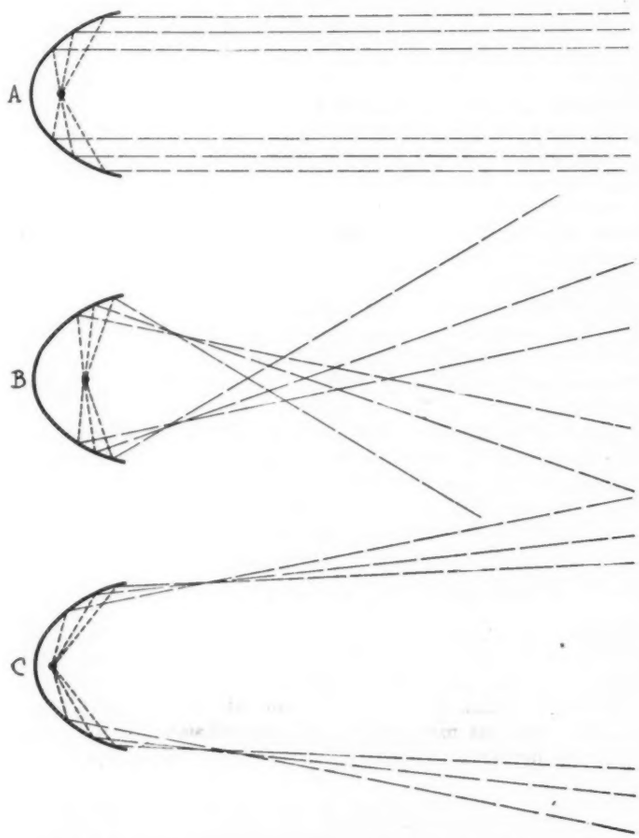


Fig. 3—The same lamp as considered in Figs. 1 and 2 with the same setting and the light it will give when the bulb is moved so as to put the filament in a different position

Adequate Light Required

This means that in making any regulation about lighting it is essential to specify enough light as well as to specify the direction of that light. The idea that glare could be cured by abolishing lamps is good enough as far as it goes, but it would merely substitute worse dangers for present ones.

Herein we find an objection to the simple method of directing light by tilting the lamp, for a tilted lamp will need to be intrinsically more powerful than an untilted one if we are to get the same *desirable* light on the road. Why this is is very easily seen from Fig. 4. This is an exaggerated diagram of the effect of tilting. With the parallel set lamp the beam strikes the road a long way ahead, when we tilt the lamp it hits the ground soon, and after the beam has hit the ground it is used up, it is no longer of much use. The middle of the beam is its brightest part, so we want to have the middle line hit the road as far ahead as we can.

Suppose we want to have it hit the road 200 ft. away and are compelled to tilt the lamp so that it strikes the ground at 150 ft., then to get the same light on the road we must increase the brilliancy so that the ray which does strike the road at 200 ft. with the tilted lamp is as bright as the middle ray of the untilted one. There are ways of overcoming this, but most of them are patented at present. So the simple thing to do is to put up with the loss of efficiency and leave it to the manufacturers to work it out for themselves.

The electrical equipment division feels that by specifying the proper tolerances for bulb manufacture and by specifying those for reflector construction, they can insure the production of lamps that only require to be tilted in order to be non-glaring. The following is an ideal of illumination to insure safety both by the provision of enough light to show the road and things upon it, and to prevent glare:

"A headlamp of an automobile will give an adequate light combined with elimination of glare when:

"1. The light is sufficient to reveal any person, vehicle or substantial object on the road straight ahead at a distance of 150 ft.

"2. There is sufficient side illumination to reveal any person, vehicle or substantial object 10 ft. ahead of and 10 ft. to one side of the lamp.

"3. The headlamp is so arranged that no portion of the reflected beam of light, when measured 75 ft. or more than 75 ft. ahead of the lamp shall rise above 42 in. above the level surface on which the vehicle stands."

This is the ideal, and it is attainable by limiting the tolerances in bulb manufacture, limiting the form and the degree of inaccuracy of the reflector and, finally, by tilting the lamp.

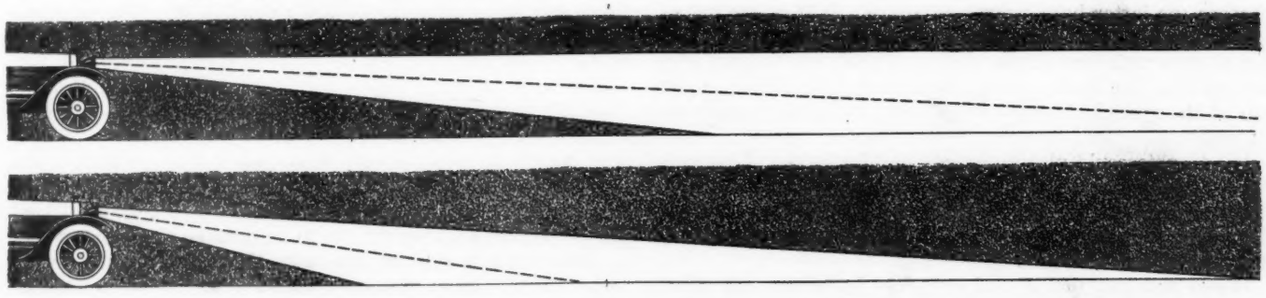


Fig. 4—An exaggerated diagram from the effect of tilting the lamp so that its rays hit the ground too soon

The Rostrum

Finding Differential Gear Ratio

EDITOR THE AUTOMOBILE:—Kindly advise how to find the gear ratio of a differential without disassembling. A Chalmers 6-30 is geared to 5 to 1 on direct. What would be the correct way of ascertaining this ratio without disassembling? If I jack up one rear wheel and put transmission in direct or high, then turn the motor by crank one revolution, and the jacked wheel only turns half way around, why do they say the engine turns one to the rear wheel's five times? Please explain.

West Chester, Pa. W. H. W.

—The gear ratio of 5 to 1 means 5 revolutions of the engine to one of the road wheels. When the differential is operating as it must be with one wheel stationary on the ground and the other turning then the rear axle ratio will only be half what it is when both wheels are turning. If your rear axle ratio is 5 to 1 you will find that with one wheel jacked up it requires 2½ turns of the engine to give you one full turn of the back wheel.

A better way is to turn the back wheel and count the number of turns made by the propeller shaft. You can usually do this by watching the universal joint. Mutiply this number of turns by two and you will have the two ratios.

Engine Needs Thorough Overhauling

Editor THE AUTOMOBILE:—I drive a 1911 Reo that has been run about 16,000 miles and seems to give as good service now as when it was new, with one exception. The third and fourth cylinders pump oil, the fourth one being the worst, so that I have to clean the spark plugs and scrape out the cylinders every 80 to 100 miles, else the engine will develop a very perceptible knock when pulling up grade.

The compression seems as good as when the car was new, but the third cylinder never did have as good compression as the other three. The fourth cylinder has good compression though it is very bad about pumping oil and fouling spark plug, and so far as I can tell, it is the cylinder that produces the knock.

Will you kindly tell me how to remedy this? Would a new set of cylinder rings do the work, and if so, what kind would be best suited for the Reo engine?

Browning, Mo. J. P. B.

—Probably your engine requires a thorough overhauling. If you cannot get equal compression in each cylinder by grinding the valves it will be necessary to examine the pistons and piston rings and also to measure the cylinders to see whether the latter have worn oval shape. If they are out of round it will be necessary to have them reground to fit oversize pistons with new piston rings. If the cylinders are perfectly round the trouble might be reduced by fitting one or two of the special rings of which there are now so many on the market.

The trouble could also be caused by dirt in the oiling system. Make sure that this is quite clean, especially that the oil returns from the crankcase to the oil reservoir are not clogged. You should wash out the whole crankcase very thoroughly with kerosene.

If you find the pistons and cylinders in perfect condition, have the lubricating system absolutely clean and still have not entirely cured your trouble, you could file the dips on the lower ends of the connecting-rods so that while they will still dip into the oil as deeply as before their lesser width will prevent so large a quantity being splashed.

Lubrication Is Provided on Grades

Editor THE AUTOMOBILE:—I have a 1916 Studebaker six-cylinder car which is lubricated by a circulating splash system. A gear pump draws the oil from the rear of the crankcase. If the oil is allowed to become a little low it will not cover the suction end of the pipe when descending steep grades. How long will the supply in the splashed troughs lubricate the engine when the pump is not feeding?

2—When there is a full supply of oil in the crankcase, it is said that there is too much lubrication in the end cylinders. Is it possible for the oil to rise so high at the ends of the crankcase that it will cover either No. 1 or No. 6 splasher troughs on grades? If not, how could a full supply cause excessive lubrication?

Denver, Col. C. E. R.

—Considering that when descending steep grades the engine is not delivering any power there is no need to worry about the condition of the oil. There will be plenty of oil throughout the engine to keep it lubricated for the longest descent.

2—It is practically impossible to design an engine for splash lubrication which will not load the end of the crankcase when the engine is tilted through a large angle. Actually to cover the splasher troughs would require a degree of tilt equivalent to an extremely steep hill.

Continental Engine in 1917 Overland

Editor THE AUTOMOBILE:—Kindly advise me whether the engine in the 1917 Overland six is made by the Continental Motor Co. The model is No. 85-6 and sells for $925.

Franklin, N. J. F. C. H.

—The Willys-Overland Co. will continue to use the Continental engine for its six-cylinder car throughout 1917.

Changing Hudson 33 Into Delivery Car

Editor THE AUTOMOBILE:—I have a 1911 Hudson 33 torpedo body five-passenger car which I wish to change into a commercial body to use for delivery of farm produce. Is there any body made to fit these conditions? The gasoline tank would have to be relocated as it is now under the front seat.

Mansfield, Mass. S. F. F.

—You would have to take this matter up with a carriage builder. There is no stock body made which would suit you. You must be very careful that you do not overload the chassis since the frame, springs and axle are only designed to sustain the weight of five passengers and any dead load which you put on it ought not to be greater than that.

Assuming you convert the body, the useful load it would carry in addition to the driver ought to be limited to 600 lb.

There is no reason why you should not continue to keep the

gasoline tank under the driver's seat. Our advice is that you discuss the matter with someone near you who you think could build a body and get his ideas on it. The usual way to get a reasonable platform space is to build wooden cross pieces which will lift the platform about 1 ft. above the top of the wheel. Possibly you could move the driver's seat forward by setting the steering gear more nearly vertical but it is very likely the position of the gear lever and of the pedals will prevent you gaining much in this way. Probably the cheapest plan would be to leave the front seat as it is and substitute a small platform for the tonneau.

Information on Nitrogen Filled Bulbs

Editor THE AUTOMOBILE:—Do nitrogen-filled bulbs give more light than regular vacuum type with the same amount of feed from battery?

2—What would be proper candlepower nitrogen bulbs to substitute for regular vacuum type 15 cp. bulbs in headlight, would it be 21 cp.?

3—What would be the approximate added burden to 6-volt battery regularly using 15 cp. vacuum type headlights to substitute 36 cp. nitrogen bulbs, the regular vacuum type consuming 2½ amp. and the 36 cp. nitrogen bulbs consuming 4 amp.?

4—Using regular vacuum type 15 cp. bulbs of 2 amp. generator shows battery charge at about 15 m.p.h. when headlights are turned on. At about what speed would battery charge using 36 cp. nitrogen bulbs of 4 amp.?

5—Does a 21 cp. nitrogen bulb, actually give 6 more candlepower than a 15 cp. regular vacuum bulb when each bulb uses 2½ amp.?

Peebles, Ohio. A. C. P.

—Yes.

2—Yes.

3—The addition would be the difference between the current drawn by the small bulb and that needed for the large one.

4—It is not possible to answer this without knowing the exact characteristic curve for the generator.

5—It ought to do so.

Fitting Route Indicator to Speedometer

Editor THE AUTOMOBILE:—I am interested in connecting a route indicator to the Warner speedometer with which my 1916 Cadillac eight is equipped, and I am at a loss how to determine the exact speed of the shaft at the point where it it connects with the speedometer.

2—The closest I can come to it is 690 r.p.m. I am advised by the Stewart people that the speed of the shaft on their old model speedometer was 2523 r.p.m., and on their 1912 model was 1009; but they failed to give me the speed of the later models.

Occoquan, Va. G. A. D.

—The speedometer shaft on your car should turn 680 times in a mile in order to register mileage correctly. It will do this if the car is equipped with standard size tires 36 by 4½ in.

2—When speedometer shaft speeds are given in the revolutions per minute this usually means revolution per minute at some particular number of miles per hour.

Oil Satisfactory in Ford Cups

Editor THE AUTOMOBILE:—Kindly advise me if it is desirable to substitute grease cups for the present oil cups on a Ford car and if they are as satisfactory as concerns lubrication as the oil cups?

2—Where can I secure grease cups for the Ford to replace the oil cups having a large grease capacity? Also cups having a large oil capacity to replace the present system?

3—Is there any power pump that has proven successful on the Ford? What are the merits of the spark plug pumps? I have heard that they are detrimental to the engine.

Hot Springs, Va. R. B. D.

—As long as you keep the oil cups filled lubrication will be just as good as you will get with grease. Many engineers greatly prefer oil to grease, as it flows much more easily in cold weather.

2—You could get greasecups or large oil cups from any good accessory house or your dealer could obtain them for you.

3—Any of several tire pumps will give you satisfaction. The spark plug pumps are very good and cannot possibly damage the engine. If you purchase one of these pumps do not forget that it is most effective when the engine is running slowly. If the engine is speeded up too much the piston in the pump will not draw in a full charge as it does not get time to make its return stroke.

55,000 Wire Wheel Cars in 1916

Editor THE AUTOMOBILE:—Kindly advise the probable number of automobiles equipped with wire wheels during the 1916 season and also the probable number of cars to be equipped with wire wheels in the 1917 season.

Johnstown, Pa. F. H. M.

—At the present time we estimate that about 55,000 new cars have been equipped with wire wheels in 1916 and the manufacturers expect that fully 200,000 will use them in 1917.

Bijur Regulator Wiring Diagram

Editor THE AUTOMOBILE:—Will you kindly give me a wiring diagram of a Bijur regulator, showing how same is connected to a 1913 Packard car generator, replacing the mercury regulator made by the Delco company.

2—Also give a diagram showing the internal circuits of same and any other data you may have explaining its operation.

New York City. B. F. K.

—Fig. 1 shows the connections to a Bijur regulator. Regarding the internal mechanism, this Bijur regulator is a vibrating field voltage controller described on page 741 of THE AUTOMOBILE for Oct. 21, 1915. The diagram of the vibrating type regulator published herewith shows all the essential details of the Bijur instrument.

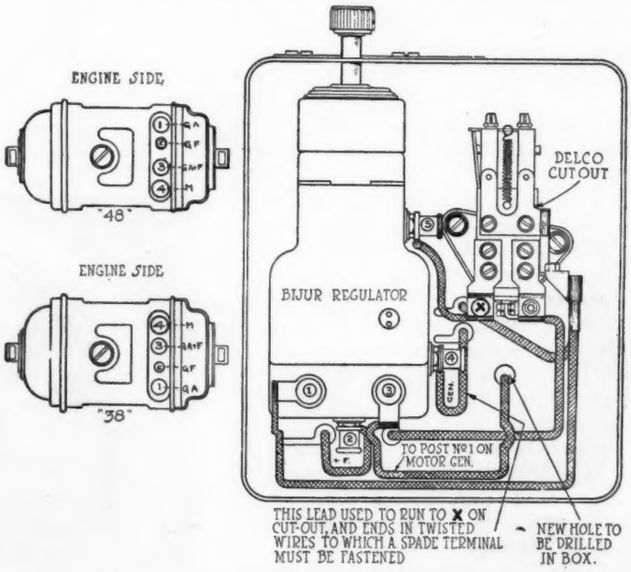


Fig. 1—Wiring diagram of a Bijur regulator, showing connections as used on a 1913 Packard generator

ACCESSORIES

Hercules Auxiliary Bearing

THESE bearings are designed to increase the carrying capacity of Ford cars and to prevent the breakage of axle shafts. The bearings remove the weight of the car and load from the axle shafts and permit the use of solid rubber tires or demountable rims by taking care of the extra weight. The manufacturer states that these bearings also eliminate wobbling of the wheels and side sway. A set consists of two combined radial and thrust bearings capable of carrying a load of 3800 lb. at axle speed. These bearings are mounted on the outer ends of the Ford rear axle housing and engage steel brackets to be fitted in the inside of the brake drums. These brackets are secured by six special bolts, replacing the bolts used for fastening the brake drums and hub flanges to the wheels. When the wheels are in place on the axle shafts, these steel brackets engage the outer race of each auxiliary bearing, bringing these bearings only 1¼ in. from the center of the wheel. Thus they carry the load close to and on the wheels. The bearings can be installed by anyone with a wrench, no machine work or change in the Ford wheels or axles being required. —Hercules Auxiliary Bearings Works, 327 S. La Salle Street, Chicago, Ill.

Superior Spot Lamp

Combining the functions of a spot and trouble light this lamp can be moved in any direction desired and throws a direct beam of light far in advance of the car. It has a silver-plated spun brass reflector and the exterior is finished in dark enamel which the manufacturer states will not peel. The lamp is fitted with an adjustable, removable mirror at the back of the clamp so that the driver can see cars coming up behind. The lamp itself is a 6 volt 21 candlepower nitrogen type with double contact, the switch being on the end of the handle. The windshield attachment is of heavy steel with strong bolts to prevent the lamp from sliding. The lamp is 6¼ in. in diameter over all and the length from the switch to the lens is 7⅞ in. A cord 10 ft. in length is supplied with each lamp for use as a trouble detector. — Pittsburgh Lamp, Brass and Glass Co., Pittsburgh, Pa.

M. and M. rim contractor

M. & M. Rim Contractor

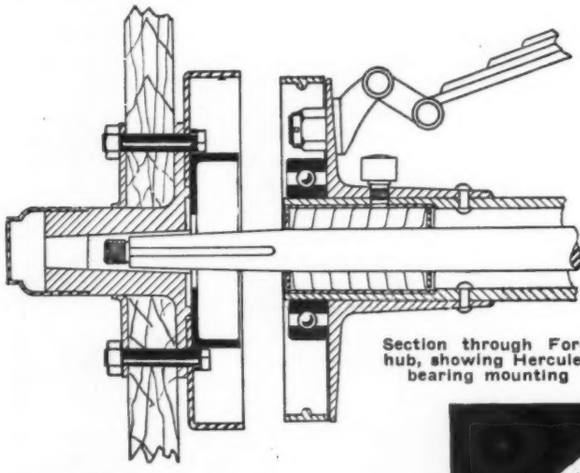
A tool for removing or replacing rims of the Standweld, Baker, Firestone, Detroit or Kelsey type. Clamps connected by a threaded rod are fastened on opposite sides of the rim, and the rim contracted by means of a turnbuckle. Turning the buckle in the opposite direction expands the rim to its original position. Price, $1.—M. & M. Mfg. Co., Bayside, N. Y.

The York Gas Saver

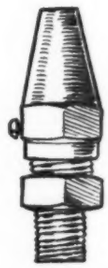
An auxiliary air valve screwed into the intake manifold. It consists of a metal nipple carrying an adjustable nozzle whereby the amount of additional air entering the manifold may be regulated. The installation requires the drilling of a 11/32 in. hole in the intake manifold just below the spread, tapping it to ⅛ in. std., and screwing in the valve. Price, $3.—York Gas Saver Co., 1518 Jefferson Avenue, East, Detroit, Mich.

Name-On Robe

The owner's name is interwoven in the edge of the robe. It is made of long fiber mohair and bound with triple-stitched felt. The robe is reversible, having one color on one side and the other color on the reverse. The name is woven so as to show on both sides. The robe is claimed to be durable and warm without being bulky or heavy. Price, 54 by 72 in., $12.50; 54 by 84 in., $15.—J. & E. Dawson, Palethorp and Somerset Streets, Philadelphia, Pa.

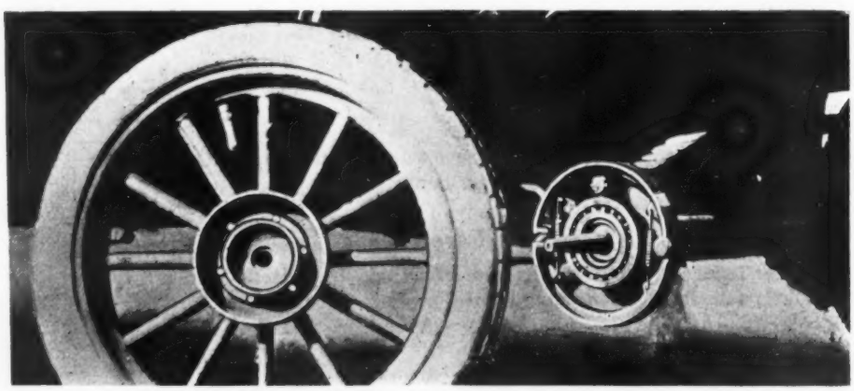


Section through Ford hub, showing Hercules bearing mounting



York Gas Saver which admits additional air intake

Superior spot and trouble light



Ford rear wheel removed, showing Hercules auxiliary bearing in place

Standards Committee Accepts Four S. A. E. Reports

(*Continued from page* 645)

width of the V is to be 3 mm. and its length 2.5 mm., as illustrated.

Location of Filament in Bulb—7—All headlamp bulbs regardless of their diameter are to have the center of the filament located in the axis of the bulb, 1¼ in. from a plane tangent to the nearer sides of the locating pins in the bulb base, as in the sketch.

Location of Receptacle in Headlamp—8—All headlamp receptacles are to be located in the reflectors so that a plane passing through the registering points of the bayonet slots is 1¼ in. from the focal point of the reflector when the receptacle is at the mid-point of its adjustment, as illustrated.

Focal Length of Reflector—9—It is tentatively recommended that all headlamp reflectors be made as near as possible to the outline of a true parabola of 1¼ in. focal length, as in the drawing.

Limits on Location of Filaments—10—Investigation is being carried on in regard to the practicability of locating filaments within limits close enough to avoid the necessity of adjustments for focusing, or at least of focusing in replacing bulbs.

11—At the present time, filaments are located in the glass portion of the bulb by eye, and the glass bulb is afterward cemented into the base, its exact position being dependent upon variation in the size of the bulb.

12—Under these conditions it is said that the total variation is held within limits of 1/16 in. plus or minus. One of the largest manufacturers of bulbs has reported that the cost of bulbs would be increased by from 5 to 10 cents each by changes in manufacturing methods which would hold the center of the filaments within 1/64 in. of the bulb axis and within 1/32 in. (plus or minus) of the standard distance from the pins in the base.

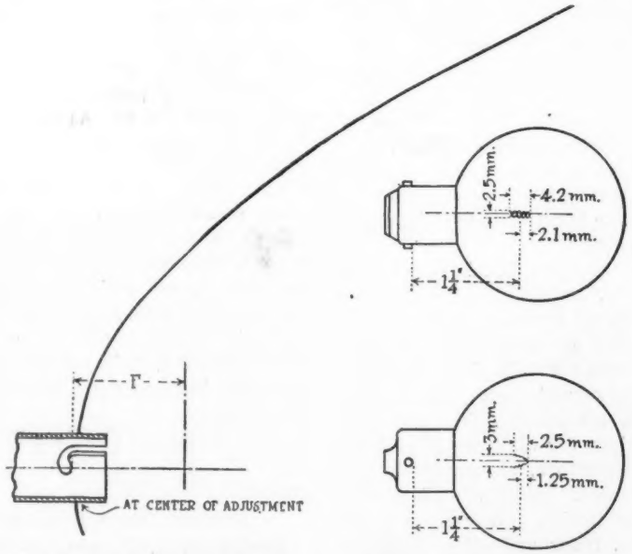
Mounting of Starters, Generators and Ignition Distributers—13—The sub-division on standards for mounting these various electrical units has been doing active work, but is not yet prepared to offer final recommendations. Definite proposals for mounting starting motors and generators have been proposed and criticized. Members of the sub-division are engaged in trying out the proposals on layouts of engines of different make, in order to revise the proposals so as to make them suitable to existing engine designs as far as possible. It is hoped that this work will be completed before the end of the present calendar year.

14—Standard dimensions for ignition distributers have been formulated with the co-operation of interested manufacturers. The dimensions are suitable for mounting the distributer either on the engine or on the generator. The proposal has not yet been submitted to the division.

Storage Battery Subjects—15—A sub-division has been appointed and has done some preliminary work in regard to terminals of storage batteries for gasoline cars. Another subject which this sub-division will consider is dimensions for storage battery compartments.

Among the speakers were A. G. Batchelder, Dr. H. M. Rowe and J. O. Lagorz of the American Automobile Assn. W. E. McKechnie, electrical engineer, Cadillac Motor Car Co., stated that the research of the headlight glare sub-division showed that the problem was very complicated and that no solution could be reached until scientific study revealed certain causes of glare not now known. To this end he proposed that a separate division be created to consist of a few members deeply versed in the subject to co-operate with other engineering bodies in the electrical and illuminating field in collaboratively solving the question. This proposal was enthusiastically received in view of the imminence of much drastic legislation at great variation pending in different states.

The problem first encountered by the sub-division was the variation in filament position on different bulbs which destroyed the focus and caused stray and reflected lights. It is working now to standardize filament position and shape but more research is needed, especially in determining correct focal length for ample illumination without glare and provision for tolerance in filament placing without manual adjustment. Mr. Rowe also supported the suggestion in telling the committee something of the existing legal situation.



Left—Sectional plan diagram of headlamp reflector and receptacle. F is focal length of reflector—1¼ in. Right—Location of filaments in bulbs. Above—Vacuum bulb. Below—Gas filled bulb

Truck Standards

Discussion of military truck standards followed the report of the truck control standards chairman, H. D. Church, Packard Motor Car Co. All the recommendations were approved with the understanding that the standards did not mean to require any segment for spark throttle levers being recognized as advantageous in commercial work and imperative in military application. The report follows:

Truck Control Standards

1—The following recommendations apply to both right and left drive trucks:

Gearshift and Hand Brake Levers—2—It is recommended that the gearshift and hand brake levers be placed at the driver's right, with the hand brake lever to the right of the gearshift lever. The hand brake lever is to be pulled back for brake application. The gearshift lever is to be fitted with a latch guarding the reverse position, or the equivalent of a latch, when used with either a three or four-speed transmission.

Gearshift Lever Handle Positions—3—It is recommended that for three-speed transmissions the positions of the gearshift lever handle be the same as recommended by the miscellaneous division for standardization for pleasure cars. Four-speed transmissions are to have the forward speeds so arranged that the gearshift handle in high speed is in the same position as with the three-speed transmission, low speed occupying the place of reverse. The location of the reverse position is to be left optional. It is further recommended that with either three-speed or four-speed transmissions, the various speeds be clearly indicated, either on the gate or at the base of the gearshift lever.

Clutch and Brake Pedal—4—It is recommended that the clutch pedal be located to the left of and the foot brake pedal to the right of the fore and aft center line of steering column.

Accelerator Pedal—5—It is recommended that the accelerator pedal be placed to the right of the brake pedal.

Spark and Throttle Hand-Levers—6—It is recommended that spark and throttle hand-levers, if used, should be located to the right of the fore and aft center of the steering column. The spark lever should be the shorter of the two and both levers carried on stationary sectors. Both levers should be arranged so that they are pushed forward to advance the spark and to open the throttle.

Military Specifications Mangled

The tentative military truck specifications were literally torn to shreds as to detail, Henry Souther maintaining stand-

(*Continued on page* 681)

Details of Argentine Trade-Mark Law—Part II

(*Continued from page* 646)

themselves aggrieved by the mark may file opposition, and the applicant's attorney is notified and given an opportunity to reply. If the opposition is based on a previous registry or is not merely capricious, the Office cannot decide the case, and the proceedings are suspended. Applicant may then ask for the case to be sent to the Federal Courts, where the proceedings take the nature of an ordinary lawsuit.

Renewals: At the end of the 10 years period the registration may be renewed for an equal period, and so on indefinitely. The proceedings are exactly the same as in the original application. The term begins as from the date of grant, although the mark is protected as against subsequent applications from the moment when it is filed.

Secret manner of printing: Applicant may keep secret the manner of printing the mark in certain cases. In such cases the process of printing must be fully described and the description filed together with the application, in a sealed envelope, which may only be opened in open court in case of litigation.

Infringement: All infringement cases are tried in the Federal Courts. The penalty (see previous clause on this subject) consists of a fine of $20 to $500 Argentine and arrest from 1 month to 1 year, not redeemable by payment of money. The goods sold under a mark declared by the court to be an infringement are confiscated and sold for the benefit of the school fund. The sentence of the Federal Court may be carried to the Federal Chamber of Appeals and the winner of the suit may then sue the loser for damages in the common courts, if so declared in the sentence.

Administration: The author would be lacking in gratitude for courteous treatment experienced from the entire staff of the Argentine Patent and Trade Mark Office during many years, if he failed to close this article without a word of commendation for them. Above all he desires to state his sincere conviction that this department is carried on in a spirit of fairness and justice, interpreting the law in so far as it lies within its province to do so, in an able and strictly impartial manner. Although it may seem to some applicants that their cases are unduly delayed, this is entirely due to the great increase in the number of applications without the corresponding increase in staff.

There are twenty-five different classifications for copyright consideration, those quoted below apply to the automobile industry:

Class 12.—Machines, apparatus and elements of transport in general, their various parts and their accessories.

Such as: Locomotives, rolling stock for railways and tramways, telpherage systems, rails, semaphores, cranes and winches, movable bridges, endless carriers, lifts or elevators, freight elevators, endless screws, automobiles, aeroplanes, airships, balloons, motorcycles, bicycles, carts and carriages in general, hydroplanes, ships, motor launches, boats, dredges, floating cranes.

Class 17.—Caoutchouc, rubber and guttapercha, wrought and unwrought and in every state of preparation, and all articles made of that substance, except those used in electricity, surgery or orthopædia.

Such as: Transmission belts, air chambers and covers for vehicle tires, balls and toys, tubes, plate, cord, etc.

Class 19.—Leather furs and skins, wrought and unwrought, not included in other classes. Saddlery and harness, trunks, and traveling goods generally.

Such as: Fur garments, harnesses, trappings, horse furnishings, whips, blankets for animals, buckles, stirrups, bits, spurs, reins, trunks and valises in general, straps, portmanteaux, walking stick cases, hat cases.

Class 20.—Electricity, electrical machinery, supplies, apparatus and accessories for the production of power, heat and light, telephony, telegraphy and wireless telegraphy.

Such as: Dynamos, alternators, resistances, magnetos, telegraphic, telephonic and radiographic apparatus, electric lamps in general; sockets, tulips and globes, motors, commutators, wire and cable for electrical use, transformers, carbons for electric lamps, insulators, voltmeters, ammeters and other measuring and experimental apparatus; insulating fabrics, accumulators, batteries and cells.

Class 14.—Apparatus and articles for heating; ventilation, illumination, refrigeration, hydrotherapy, sanitary articles, machines, apparatus and supplies for cleaning, in general, washing, soaking and cleaning clothes.

Such as: Ranges, braziers, heating devices, stoves, central heating boilers, radiators, thermo-syphons, still worms, ventilators, aspirators, air injectors, gas generators, lamps of all kinds, lighting devices, luminous buoys, chandeliers, lanterns (of all kinds), freezing machines, machines for making ice and ice creams, refrigerators, shower bath apparatus, douches, baths of all kinds, bath-tubs, lavatories, water-closets, bidets, syphons, traps and other sanitary articles, machines, apparatus and articles for washing, wringing, ironing, and drying; carpet, curtain and tapestry cleaners, vacuum cleaners, brooms, feather dusters, brushes, mops, polishing cloths and skins; metal, wood, clothes, and leather cleaning soaps, pomades, powders and liquids; starch, borax, soda, bluing, preparations for polishing and waxing floors, stain erasers, etc.

Class 15.—Fabrics and textures in general; knitted fabrics; table linen, and linens in general.

Such as: Wool, silk, linen, cotton, jute and other vegetable fiber cloths and fabrics, waterproof or not; mixtures of the same; knitted goods, stockings, undershirts, underwear made of these fabrics; table cloths and napkins, sheets, pillow cases, quilts and blankets.

Class 10.—Hardware, cutlery, paints and colors, locksmithery, ironmongery, builders' hardware, house furnishing, bazaar articles and tinmongery; non-electric cable, canvas goods; picture frames and moldings; basketware, etc.

Such as: Tools in general with or without edge or point, not otherwise classified; razors and safety razors; cutlasses; knives, forks and spoons; daggers, colors and paints; varnishes, sealing wax, lacquers, wall paper, brushes, oil and turpentine for paints, rope, twine, and cord of hair or fiber, locks, bolts, hinges, chains, anchors, articles of ironmongery, of tin, brass, and the like; kitchen utensils, iron glazed and enamel ware, nails and screws, tents, flags, canvas awnings, sails, bags of any kind of cloth for any purposes; insulating cloths and papers; damp-proof materials; bottle caps, corks and metallic stoppers, fire kindlers, night tapers, baskets and similar objects in general; chains of all kinds, transmission belts in general; except those of caoutchouc or rubber.

Class 5.—Machines and apparatus of every kind of industry not otherwise classified, parts of the same; accessories and implements for dyeing or filtering. Machines, apparatus and implements of agriculture, aviculture, apiculture, fish culture, dairy, grape, wine culture, forestry, and cooperage.

Such as: Pumps, generators for motors, machines driven by water, gas, naphtha, steam and the like, machine ing machines and needles for same; fire tools, boilers not otherwise classified; motors, sewing, knitting and embroider-extinguishing engines, pumps and apparatus, etc.

(*To Be Continued.*)

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Doehler Moves Brass Dept.

BROOKLYN, N. Y., Oct. 16—The Doehler Die Casting Co. has removed its brass-back bearing department from Brooklyn to its new Toledo, Ohio, plant.

Accessory Spaces Allotted to 87 Concerns

(*Continued from page* 642)

Goods Co.; Lumen Bearing Co.; Parry Mfg. Co.; Wagner-Hoyt Electric Co.; West Side Foundry Co.; Rubber Insulated Metals Corp.; and the Syracuse Malleable Iron Works.

The list of exhibitors follows:

NEW YORK AND CHICAGO

A. B. C. Starter Co.....Detroit, Mich.
American Bronze Co.....Berwyn, Pa.
American Hardware Corp. (Corbin Screw Corp. Division).....New Britain, Conn.
Au-To Compressor Co.....Wilmington, Ohio
Automobile Supply Mfg. Co..Brooklyn, N. Y.
Benford Mfg. Co.....Mt. Vernon, N. Y.
Brown-Lipe Chapin Co.....Syracuse, N. Y.
Brown-Lipe Gear Co.....Syracuse, N. Y.
Brunner Mfg. Co.....Utica, N. Y.
Buda Co.....Harvey, Ill.
Byrne-Kingston & Co.....Kokomo, Ind.
Carr Co., F. S.....Boston, Mass.
Celfor Tool Co.....Buchanan, Mich.
Champion Ignition Co.....Flint, Mich.
Corning Glass Works.....Corning, N. Y.
Cowles & Co., C.....New Haven, Conn.
Corcoran-Victor Co.....Cincinnati, Ohio
Cramp & Sons Ship & Engine Building Co., Wm.....Philadelphia, Pa.
Dann Products Co.....Chicago, Ill.
Detroit Weatherproof Body Co.....
Dixon Crucible Co., Joseph..Jersey City, N. J.
Doehler Die Casting Co.....Brooklyn, N. Y.
Dyneto Electric Co.....Syracuse, N. Y.
E. A. Laboratories Co., Inc...Brooklyn, N. Y.
Eclipse Machine Co.....Elmira, N. Y.
Electric Storage Battery Co., Philadelphia, Pa.
Evapco Mfg. Co.....Detroit, Mich.
Ferro Machine & Fdry. Co...Cleveland, Ohio
Findeisen & Kropf Mfg. Co.....Chicago, Ill.
Gabriel Mfg. Co.....Cleveland, Ohio
Gemco Mfg. Co.....Milwaukee, Wis.
General Electric Co.....Schenectady, N. Y.
Globe Machine & Stamp. Co..Cleveland, Ohio
Gould Storage Battery Co....New York City
Gray & Davis.....Boston, Mass.
Halladay Co., L. P.....Streator, Ill.
Hall-Thompson Co.....Hartford, Conn.
Hartford, Inc., Edward V..Jersey City, N. J.
Hassler, Robert H.....Indianapolis, Ind.
Hayes Mfg. Co.....Detroit, Mich.
Hayes Wheel Co.....Jackson, Mich.
Heinze Co., John O.....Springfield, Ohio
Heinze Electric Co.....Lowell, Mass.
Kellogg Mfg. Co.....Rochester, N. Y.
Kent Mfg. Wks., Atwater...Philadelphia, Pa.
Klaxon Co. .....Newark, N. J.
Kokomo Electric Co.....Kokomo, Ind.
Leather Tire Goods Co..Niagara Falls, N. Y.
Leece-Neville Co. .....Cleveland, Ohio
Lipman Air Appliance Co.....Beloit, Wis.
Lumen Bearing Co.....Buffalo, N. Y.
Mann Co., F. W.....Milford, Mass.
Master Carbureter Corp.....Detroit, Mich.
Mosler & Co., A. R.....Mt. Vernon, N. Y.
Motometer Co.....Long Island City, N. Y.
New York Coil Co.....New York City
North East Electric Co.....Rochester, N. Y.
Otis Elevator Co.....New York, N. Y.
Pantasote Co. .....New York, N. Y.
Parry Mfg. Co.....Indianapolis, Ind.
Perfection Spring Co.....Cleveland, Ohio
Piel Co., The G.....Long Island City, N. Y.
Pest-O-Lite Co.....Indianapolis, Ind.
Royal Equipment Co.....Bridgeport, Conn.
Sager Co., J. H.....Rochester, N. Y.
Schrader's Son, Inc., A.....Brooklyn, N. Y.
Shakespeare Co.....Kalamazoo, Mich.
Shaler Co., C. A.....Waupin, Wis.
Sparks-Withington Co.....Jackson, Mich
Splitdorf Electrical Co.....Newark, N. J.
Springfield Body Co.....Springfield, Mass.
Standard Thermometer Co.....Boston, Mass.
Standard Welding Co.....Cleveland, Ohio
Stewart Warner Speedometer Corp., Chicago, Ill.
Stromberg Motor Devices Co....Chicago, Ill.
U. S. Light & Heat Corp., Niagara Falls, N. Y.
Universal Shock Eliminator, Inc...New York
Vacuum Oil Co.....New York, N. Y.
Van Sicklen Co.....Elgin, Ill.
Veeder Mfg. Co.....Hartford, Conn.
Voorhees Rubber Mfg. Co..Jersey City, N. J.
Wagner-Hoyt Electric Co...New York, N. Y.
Waltham Watch Co.....Waltham, Mass.
Westinghouse Elec. & Mfg. Co. Pittsburgh, Pa.
West Side Fdry. Co.....Troy, N. Y.
Wheeler-Schebler Carbureter Co., Inc., Indianapolis, Ind.
Willard Storage Battery Co...Cleveland, Ohio

NEW YORK ONLY

Blackledge Mfg. Co., J. W.....Chicago, Ill.
Bosch Magneto Co.....New York, N. Y.
Breeze Carbureter Co.....Newark, N. J.
Budd Mfg. Co., Edward G..Philadelphia, Pa.
English & Mersick Co.....New Haven, Conn.
General Bakelite Co.....New York, N. Y.
Hale & Kilburn Co.....Philadelphia, Pa.
Hartford Machine Screw Co..Hartford, Conn.
Herz & Co.....New York, N. Y.
Janney-Steinmetz & Co....Philadelphia, Pa.
Light Mfg. & Fdry. Co.....Pottstown, Pa.
Morse Chain Co.....Ithaca, N. Y.
Rubber Insulated Metals Corp., Plainfield, N. J.
Syracuse Malleable Iron Wks., Syracuse, N. Y.
Ward Leonard Elec. Co....Mt. Vernon, N. Y.
Zenith Carbureter Co.....Detroit, Mich.

CHICAGO ONLY

Badger Brass Mfg. Co.....Kenosha, Wis.
Continental Motors Co.....Detroit, Mich.
Edison Storage Battery Co.....Orange, N. J.
Garford Mfg. Co.....Elyria, Ohio
Imperial Brass Mfg. Co.....Chicago, Ill.
Oakes Co.....Indianapolis, Ind.
Remy Electric Co.....Anderson, Ind.
Simms Magneto Co.....East Orange, N. J.
Vesta Accumulator Co.....Chicago, Ill.
Warner Gear Co.....Muncie, Ind.
Waukesha Motor Co.....Waukesha, Wis.
Wilson & Co.....Chicago, Ill.

The complete list of exhibitors last year showed 306 accessory exhibitors at New York and 186 at Chicago.

Stiger Elected President

C. W. Stiger of the Stromberg Motor Devices Co., was yesterday appointed president of the Motor and Accessory Manufacturers, succeeding F. Hallett Lovell, who resigned. L. M. Bradley, prominent in the affairs of the N. A. A. M., and since connected with the automobile and accessory fields, has become manager of the association, succeeding W. M. Sweet, who has resigned to become the assistant to the president of the United Motors Corp. Mr. Sweet was yesterday elected a member of the board of directors to succeed Mr. Lovell and will serve until 1919. Mr. Sweet was also elected chairman of the 1917 banquet committee. Christian Girl of the Perfection Spring Co., was elected as a member of the board to succeed C. E. Whitney, resigned, His term will expire in 1919.

The association also voted to become a member of the Chamber of Commerce of the United States of America.

The following new members were admitted:

A-B-C Starter Co., Detroit, Mich., manufacturer of auto electric starting and lighting systems.

Celfor Tool Co., Buchanan, Mich., manufacturer of internal gear drive motor truck axles and high-speed drills.

Corning Glass Works, Corning, N. Y., manufacturer of technical glassware.

Detroit Weaterproof Body Co., Detroit, Mich., manufacturer of detachable closed tops.

Evapco Mfg. Co., Detroit, Mich., manufacturer of Evapco Gas Savers and Jiffy Starters.

Gillette Motors Co., Mishawaka, Ind., manufacturer of motors, manifolds, piston rings.

The Hall-Thompson Co., Hartford, Conn., manufacturer of polishes, dressings, enamels, chemical compounds.

Lipman Air Appliance Co., Beloit, Wis., manufacturer of air pumps, water and oil calculating pumps and other parts.

Morse Chain Co., Ithaca, N. Y., manufacturer of silent chain and sprocket wheels.

New York Coil Co., 338 Pearl Street, New York City, manufacturer of ignition devices, auto accessories.

Perlman Rim Corp., 1790 Broadway, New York, manufacturer of demountable automobile rims and parts.

Rubber Insulated Metals Corp., Plainfield, N. J., manufacturer of tires, tubes and insulated tools.

Universal Shock Eliminator, Inc., 8 West Sixty-second Street, New York City, manufacturer of shock eliminators, safety buffers.

Wagner-Hoyt Electric Co., 1902 Broadway, New York City, manufacturer of starting, lighting, ignition batteries and switches.

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Lyons Fair Despite War

NEW YORK CITY, Oct. 12—American manufacturers will have an opportunity of exhibiting their wares in southern France at the annual fair at Lyons which will be held, despite the war, on March 1 to 15, 1917. The State Department has placed $500 at the disposal of the American consul which will enable him to distribute the catalogs, etc.

Catalogs may be forwarded directly to the U. S. Consul at Lyons, and should be printed in French.

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Demountable Top for Buick

NEW YORK CITY, Oct. 17—The Buick Motor Co. is equipping its touring cars with an all-weather top which is demountable. This body will be standard equipment and will cost $212 extra in this city.

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All-Weather Top for Chevrolet

NEW YORK CITY, Oct. 17—The Chevrolet Motor Co. is supplying as standard equipment an all-weather top which is removable. This top, which is made by the Detroit Weather Proof Body Co., will cost $70 extra.

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S. A. E. Reports Accepted

(*Continued from page* 679)

ards should be mainly confined to results, not means, except in cases where conclusive and recognized data are at hand. K. W. Zimmerschied, General Motors Corp., on the contrary, urged that uniformity of war trucks was of greater importance than what construction is best. F. A. Whitten, General Motors Truck Co., held out for more detailed specifications on the plea that safety demands the use of that which is known to be good, regardless of possible merit of unrecognized designs. Mr. Souther suggested a tread to fit railroads, since many will run on rails. Written discussions by John Younger, Pierce-Arrow Motor Car Co., and C. H. Taylor, Republic Motor Truck Co., disagreed with the detail requirements.

All agreed subject too big for hasty action. A. L. Riker said single paragraphs should be whole papers for discussion.

Engine and Transmission

Chairman W. T. Fishleigh of the engine and transmission division, reported progress on valve-timing data with characteristic curves, standards for poppet valves, starting cranks and belts for fans. Engine support arms and fans were delegated to sub-committees, but the division submitted engine test forms for action. Detail changes suggested and extension to cover aero and tractor engines were agreed upon for final submission in January. R. McA. Lloyd, consulting engineer, urged quick action, as standard engine test forms are greatly needed.

Industrial Miscellany

Factory

Stearn's Wear Proof Tire Co., Canada, with W. H. Matthews as president and offices in Toronto, Ont., has secured the Canadian manufacturing rights for the Stearns wear proof inner tubes.

Falls Motors Corp., Sheboygan Falls, Wis., office and shop executives, has organized an association for the promotion of business and industrial efficiency and social welfare.

Ladish-Obenberger Drop Forge Co., Milwaukee, has arranged for considerable extensions of its plant in Cudahy, Milwaukee county. Ground has been broken for a one-story steel and brick addition, 50 by 200 ft. The plant has been operated on a 24-hr. basis for many months.

Waukesha Motor Co., Waukesha, Wis., will award contracts for the erection of its new administration building, which will embody quarters for the engineering department and draughting rooms. The building is to be of brick and steel, 44 by 88 ft., two stories and basement, and cost $25,000.

Geo. P. Meyers Machine Co., Sheboygan, Wis., manufacturing Wisconsin motor trucks, is building its first 5-in. model.

Paige-Detroit Motor Car Co., Detroit, has received an order from the Bigelow-Willey Co. of Philadelphia for $129,000 worth of enclosed cars. This is one of the largest orders for enclosed cars that the company has received.

Federal Rubber Mfg. Co., Cudahy, has started work on the new six-story manufacturing building. It will be 100 x 157 ft. in size and cost $200,000. It is one of the principal units of the $1,000,000 improvement scheme undertaken some time ago, after the Fisk interests bought the controlling interest from the Milwaukee stockholders.

Savage Tire Co., San Diego, Cal., will add a warehouse of brick and steel construction, adjoining its present building.

Minnesota Tire & Rubber Co. will be formed with a capital stock of $200,000 by H. L. Werner, Red Wing, Minn; H. A. Trenholm, Minneapolis, and J. W. Adams, Ellsworth, Wis. Headquarters will be at St. Paul, Minn. The plant location has not been decided on.

Sterling Automobile Mfg. Co. is rushing its plant at Amston, Conn. The company now occupies a plant in Paterson, N. J.

Partridge Rubber Co., Montreal, Ont., will take over the plant of the Standard Tire & Rubber Co., Guelph, Ont.

Star Motor Car Co., Cincinnati, Ohio, has been formed with $200,000 capital and will establish a plant for assembling steam-driven automobiles. R. M. Wallingford, 1003 Race Street, is secretary.

Keystone Tire & Rubber Co., Pittsburgh, Pa., will build a new plant at Penn Station along the Pennsylvania railroad. The plant will consist of a factory building, three stories, 60 by 190 ft., and of brick and steel construction.

Commercial Automobile Co., Lexington, Ky., will equip a plant for assembling automobile running gears and bodies and for the manufacturing of bodies, etc. The equipment will cost $8,000.

Twin City Four Wheel Motor Drive Co., St. Paul, Minn., is building an addition to cost $30,000.

Mohawk Rubber Co., Akron, Ohio, is gradually finishing its $100,000 addition. The new addition consists of a three-story annex to the building recently completed and an additional story on an old building.

F. L. Jacob Co., Detroit, Mich., will build a one-story factory for the manufacture of automobile parts at a cost of $30,000.

E. H. Orersmith, Jonesville, Mich., who is building motor trucks of the front-drive type on a small scale, is negotiating with the business men's association of Waukesha, Wis., with a view to establishing a plant at that point.

American Brass Co., Kenosha, Wis., has awarded contracts for the erection of a new office building, 48 by 100 ft., three stories and basement, and a private garage and service shop, 30 by 120 ft., one story high. Both structures will be of fireproof construction equipped with sprinkler systems.

Personals

N. A. Young has been made sales manager of the Angsten-Koch Co., Chicago. He was formerly assistant sales manager of the Metal Specialties Mfg. Co.

R. V. Lull has been made sales promotion manager of the King Motor Car Co., Detroit. He was formerly in the sales department.

H. A. Harris, formerly of the Hudson agency at Portland, Me., has been appointed manager of the Oldsmobile branch there.

P. W. Runyan has been put in direct charge of publicity by the Westcott Motor Car Co., Springfield, Ohio. He was formerly assistant to sales and advertising manager of the Robbins & Myers Co., Springfield.

The Automobile Calendar

ASSOCIATIONS

Oct. 25-26—Columbus, Ohio, Automobile Trade Assn., second annual meeting, Virginia Hotel.

Oct. 26—Philadelphia, Pa., Section meeting of Society of Automobile Engineers. Paper by Herbert Chase.

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

CONTESTS

Oct. 21—Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.

Oct. 22-23—Los Angeles, Cal., Commercial Car Reliability Tour.

Oct. 28—New York Speedway Race, championship.

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race, Arizona State Fair.

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April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23 — Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14 — Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15 — Providence, R. I., Speedway Race, Championship.
Race, Championship.

Sept. 29—New York, Speedway

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Oct. 14 - 21 — Dallas, Texas, Show, State Fair.

Oct. 14-21 — Pittsburgh, Pa., Thirteenth Annual Show, Motor Square Garden. Automobile Dealers' Assn. of Pittsburgh.

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers Assn.

Dec. 2-9 — Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13, 1917—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9 - 10 — Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 27-Feb. 3, 1917 — Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6 - 10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17 — Davenport, Ia., Show, Coliseum Bldg. Tri-City Automobile Trade Assn.

TRACTOR

Oct. 14-29—Dallas, Tex., Demonstration, Texas State Fair.